PAGE'S WEEKLY.—February 24, 1905. Thin Paper Copy for Circulation Abroad.

No. 24. Vol. 6.

SIXPENCE.
(Registered as a Newspaper.)

FRIDAY,
FEBRUARY 24, 1905.

PAGE'S WEEKLY

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The Hardy Patent Pick Company,
LIMITED.
SHEFFIELD, ENGLAND.

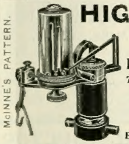
PAGE'S WEEKLY Miscellaneous

Mr. G. H. HUGHES, M.I.Mech.E.,

Consulting and Organising Engineer for Water Works and Industrial Undertakings,

97, QUEEN VICTORIA ST., LONDON, E.C.

Telephone No.: 5754 Bank. Write for particulars.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Water stored where most convenient under pressure and automatically distributed.

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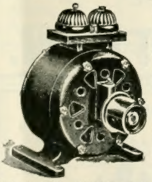

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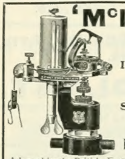

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PATENT WATER-TUBE BOILERS.

These Boilers are in use throughout the world to the extent of 4,700,000 h.p., generating steam for all purposes, and fired with all kinds of fuel.
See our Advertisement appearing March 17th, page 45.

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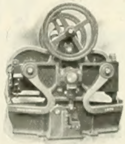

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PAGE'S WEEKLY Miscellaneous

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See our Advertisement appearing March 17th.
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FOR RAISING SEWAGE, SLUDGE, WATER, &c.
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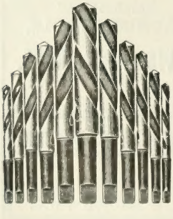

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PAGE'S WEEKLY Miscellaneous

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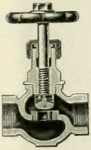

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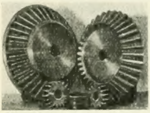

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Modern Wire-Working Machinery,
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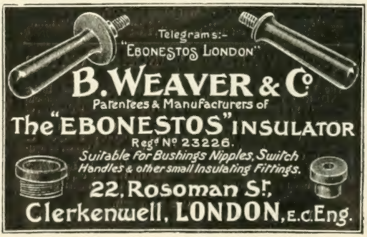

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Suitable for Bushings Nipples, Switch Handles & other small Insulating Fittings.
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PAGE'S WEEKLY Contracts

CONTRACTS.

WESTERN VALLEYS (MON.) SEWERAGE BOARD.

CONTRACT No. 1.

CONSTRUCTION OF MAIN OUTFALL AND BRANCH SEWERS.

Notice is Hereby Given that the Western Valleys (Mon.) Sewerage Board are prepared to receive **TENDERS** for the **CONSTRUCTION** of the above **WORKS**, consisting of the Main Outfall Sewer, Tank Sewer, and Sea Outfall, from Aberbeeg to low-water mark in the Bristol Channel, about 17½ miles in length varying from 2ft. 6in. to 11ft. in diameter, of brick, concrete, cast iron and steel; the Nantyglo Branch, from Nantyglo to Aberbeeg, about 6½ miles in length, varying from 12in. to 21in. in diameter, of earthenware and steel pipes; the Cwmtillery Branch, about 1¼ miles in length, 12in. and 15in, in diameter, of earthenware and steel pipes; the Ebbw Vale Branch, from Beaufort to Aberbeeg, about 8½ miles in length, varying from 12in. to 18in. in diameter, of earthenware and steel pipes; being a total length of about 35 miles, together with Penstock Chamber, Manholes, Chambers, Inspection Shafts, Ventilators, Penstocks, Storm Overflows, Connecting Chambers, and Miscellaneous Works in connection therewith.

Drawings and Specification of the Works may be seen at my offices as below, at the offices of Mr. BALDWIN LATHAM, M.Inst.C.E., Parliament Mansions, Victoria Street, Westminster, and Mr. GEORGE CHATTERTON, M.Inst.C.E., 6, The Sanctuary, Westminster.

A limited number only of the quantities, specifications, schedules, and forms of Tender are available, and may be obtained from the above Engineers, on deposit of £25 (crossed cheque only), which will be returned, after a contract has been entered into, to every person who has sent in a *bonâ fide* Tender, and has returned the documents entrusted to him.

Sealed Tenders on the forms supplied, endorsed "Tender for——— Sewerage Works, Contract No. 1," are to be delivered at my offices, 24, Stow Hill, Newport, Mon., on or before 11 a.m., on Saturday, the 8th day of April, 1905.

The Board do not bind themselves to accept the lowest or any Tender.

Dated this 10th day of February, 1905.

T. S. EDWARDS,
Clerk to the Western Valleys (Mon.) Sewerage Board.
24, Stow Hill, Newport, Mon.

AXBRIDGE UNION RURAL DISTRICT COUNCIL.

HIGHBRIDGE WATER SUPPLY.

CONTRACT No. 1.

TENDERS are invited for SUPPLYING about 600 TONS of CAST IRON SOCKET WATER PIPES, 7in. to 4in. in diameter, to be delivered at Axbridge and Highbridge Station, or other specified place.

Specification and Quantities, with form of Tender, may be obtained from the Engineer, A. POWELL, M.I.C.E., 3, Unity Street, College Green, Bristol between the hours of 10 and 5, 10 to 1 Saturdays.

Sealed Tenders, endorsed "Tender for Cast Iron Pipes" to be sent to me, the undersigned, at my office, on or before the 13th day of March.

Contractors will be required to deposit £5 for bill of quantities, which sum will be returned upon receipt of *bonâ fide* Tender.

The Council do not bind themselves to accept the lowest or any Tender.

WILLIAM REECE,
Clerk to the said Council.
Rural District Council Office,
Axbridge, Somerset, February 15th, 1905.

BRUMBY AND FRODINGHAM WATER SUPPLY.

The Brumby and Frodingham Urban District Council invite TENDERS for the MANUFACTURE and DELIVERY of about 650 TONS of CAST IRON WATER PIPES and IRREGULARS, of diameters ranging from 7in to 3in.

Specifications and forms of Tender may be obtained from Mr. ALFRED ATKINSON, C.E., of Brigg, on payment of a deposit of £2, which will be returned on receipt of a *bonâ fide* Tender, accompanied by the documents.

Sealed Tenders on the forms supplied, endorsed "Tender for Pipes," must be delivered at my office not later than the 10th March, 1905.

The Council do not bind themselves to accept the lowest or any Tender.

G. S. SOWTER,
Clerk to the Council.
Brigg, February 15th, 1905.

BROADSTAIRS AND ST. PETER'S URBAN DISTRICT COUNCIL.

RUMFIELDS PUMPING STATION.
PUMPING MACHINERY.

TENDERS are invited for the CONSTRUCTION, DELIVERY, and ERECTION at the above Station of a HORIZONTAL TANDEM COMPOUND ENGINE, CONDENSER, WELL PUMPS, and all accessories.

Copies of the Specification and Plans can be obtained at the office of the Council's Consulting Engineer, Mr. PERCY GRIFFITH, M.Inst.C.E., F.G.S., 54, Parliament Street, Westminster, S.W., on payment of a deposit of £5, which will be returned to those from whom *bonâ fide* Tenders shall have been received on or before the date hereafter named.

Early application is necessary, as only a limited number of copies will be issued to contractors.

Sealed Tenders, on the form provided for the purpose, must be delivered at the Offices of the Council, on or before the 11th March, 1905.

The Council do not bind themselves to accept the lowest or any Tender.

By order,
L. A. SKINNER,
Clerk of the Council.
Council Offices, Broadstairs,
February 16th, 1905.

GLEMSFORD WATER SUPPLY.—The

Glemsford Urban District Council are prepared to receive TENDERS for the following:—

CONTRACT No. 2.—CAST IRON PIPES and SPECIALS: 2¾ miles of 5, 4, and 3in. Socket Pipes, Bends, Branches, &c.
CONTRACT No. 3.—LAYING and JOINTING about 2¾ miles of CAST IRON PIPES, FIXING SLUICE VALVES, HYDRANTS, &c.
CONTRACT No. 4.—ERECTION of BRICK WATER TOWER about 19ft. diameter and 45ft. high; also a PUMPING STATION.
CONTRACT No. 5.—One 13 B.H.P. OIL ENGINE and ONE VERTICAL THREE-THROW RAM PUMP with all accessories.
CONTRACT No. 6.—STEEL TANK, 20ft. 3in. diameter by 15ft. 6in. deep, erected on Water Tower.

Plans may be seen and specifications and quantities obtained from the Engineer, Mr. J. T. EAYRS, M.Inst.C.E., Clarence Chambers, 39, Corporation Street, Birmingham, on and after the 11th inst., on payment of a deposit of Two Guineas in respect of each contract, which will be repaid only on receipt of a *bonâ fide* Tender, and the return of all the documents fully priced in.

Plans in connection with Contracts 3 and 4 may also be inspected at the office of the Surveyor to the District Council of Glemsford.

Tenders to be sent in addressed to me on or before the 1st day of March, 1905, endorsed "Water Supply Contract No. —" as the case may be.

The Council do not bind themselves to accept the lowest or any Tender.

THOS. BATES, Clerk to the Urban District Council.
Glemsford, Suffolk, February 1st, 1905.

COUNTY BOROUGH OF SOUTH SHIELDS.

CORPORATION ELECTRICAL SUPPLY AND TRAMWAYS DEPARTMENTS.

The CORPORATION of South Shields are prepared to receive TENDERS for the SUPPLY, DELIVERY, and ERECTION of the FOLLOWING PLANT in connection with the

ELECTRICITY SUPPLY DEPARTMENT.

CONTRACT No. 67.—One Multitubular Marine Type Boiler, with Chimney and Mountings.
" " 68.—Two Medium-Speed Open-Type Vertical Engines for 2,550-kw. Direct-Current Traction Generators.
" " 69.—Two 550-kw. Direct-Current Traction Generators.
" " 70.—Traction Switchboard.

TRAMWAYS DEPARTMENT.

CONTRACT No. 4.—Electric Tramcars, complete with "Brill" Trucks.

Copies of Specifications, Conditions, Form of Tender, also Form of Contract, can now be obtained from Mr. J. H. CAWTHRA, M.I.E.E., Borough Electrical Engineer, South Shields, on payment of Two Guineas for each Contract which sum will be returned on receipt of a *bonâ fide* Tender for each Contract.

Tenders on the form supplied, sealed and endorsed "Tender for Boilers, Engines, Generators, Switchboard, or Tramcars," as the case may be, must be delivered to me at my offices, Court Buildings, South Shields, on or before noon of the 13th March, 1905.

The Corporation do not bind themselves to accept the lowest or any Tender.

J. MOORE HAYTON, Town Clerk.

February 3rd, 1905.

PAGE'S WEEKLY Contracts

GREAT WESTERN RAILWAY.

The DIRECTORS of this Company are prepared to receive TENDERS for the SUPPLY, DELIVERY, and ERECTION of the FOLLOWING PLANT in connection with their Electricity Generating Station at Park Royal and proposed Sub-Stations and Distributing Centres at various places:—

SPECN. 11.—High and Low Tension 3-Phase and Direct-current Switch-boards and Battery Boosters at Park Royal. All Sections must be tendered for.

SPECN. 14.—3-Phase Static Transformers and High and Low Tension Switch-boards at various Sub-stations and Lighting Distributing Centres between Paddington and Park Royal and Paddington and Hammersmith. All Sections must be tendered for.

SPECN. 15.—High and Low Tension 3-Phase and Direct-Current Switchboards at Royal Oak, Shepherd's Bush, and Old Oak Common Sub-stations.

Sec. A.—3-Phase Switchboards.
" B.—Direct Current Switchboards.
" C.—Six Motor-driven Boosters (Four Reversible and two Milking) in connection with Storage Batteries at Royal Oak and Shepherd's Bush Sub-stations.

All Sections should be tendered for if possible, but Tenders for Section A alone or for Sections B and C together will be considered. The Company reserve the right of accepting a Tender for any one of the different Sections alone.

Copies of the Specifications, Forms of Tender, Drawings and General Conditions can be obtained on and after Tuesday, the 14th instant, at the offices of the Consulting Engineers, Messrs. KENNEDY AND JENKIN, 17 Victoria Street, London, S.W., between the hours of 10 a.m. and 4 p.m., on payment of Two Guineas for each Specification, which will be refunded on the receipt of a *bonâ fide* Tender. The fee, which must be paid by cheque, will not be returnable until the Tenders have been adjudicated upon.

Tenders, addressed to "The Secretary, Great Western Railway, Paddington Station, W.," and marked outside "Tender for Electric Power and Lighting—Specification No. '11,' '14,' or '15,'" as the case may be, will be received on or before Monday, March 13th.

The Directors do not bind themselves to accept the lowest or any Tender, and no allowance will be made for any expense incurred in the preparation of a Tender.

G. K. MILLS,
Secretary.

Paddington Station, London, February 8th, 1905.

WIMBLEDON URBAN DISTRICT COUNCIL.

ELECTRICITY DEPARTMENT.

The above Council is prepared to receive TENDERS for the supply of the Articles enumerated below during the year ending March 31st, 1906:—

3. Engine-room Stores.
4. Cables.
5. Joint-Boxes and Jointing Materials.
6. Transformers.
7. Meters.
8. Oils.
9. Incandescent Electric Lamps, Carbons, and Accessories.
10. Iron Castings.

Forms of Tender and Specifications, with Conditions of Contract, may be obtained at the Office of the Electrical Engineer, Durnsford Road, Wimbledon, where Samples may be inspected.

Sealed Tenders, endorsed "Tender for———," are to be addressed to the Chairman of the General Purposes Committee, and delivered at my Office, 12, Queen's Road, Wimbledon, before noon on Saturday, the 4th day of March, 1905.

R. H. S. BUTTERWORTH, Clerk to the Council.

Council Offices, Wimbledon, February 7th, 1905.

METROPOLITAN BOROUGH of STOKE NEWINGTON.

ELECTRIC LIGHTING.

The Council of the Metropolitan Borough of Stoke Newington are prepared to receive TENDERS for the Supply, Delivery, and Erection of the following Sub-station Plant and Mains:—

Section 1.—TRANSFORMERS, THREE-PHASE MOTOR-GENERATORS, BOOSTERS, &c.
Section 2.—Extra H.T. and three-wire L.T. SWITCHBOARDS.
Section 3.—STORAGE BATTERY.
Section 4.—L.T. DISTRIBUTION MAINS.

Contractors may tender for one or more of the above sections, but not for part of a section.

Specifications and plans may be seen at the Offices of the Engineers, Messrs. TALBOT AND STEVENSON, 26, Victoria Street, London, S.W., but copies of these with general conditions and form of Tender may be obtained only at the offices of W. F. LOVEDAY, Esq., Borough Surveyor, Town Hall, Milton Road, Stoke Newington, N., on or after the 6th day of February, on deposit of cheque value One Guinea for each section, which will be returned on receipt of a *bonâ fide* Tender.

Sealed Tenders endorsed "Section———, Electric Lighting," are to be addressed to the Electric Lighting Committee, and must be delivered at the Town Hall, Milton Road, Stoke Newington, N., at or before 4 o'clock p.m. on Wednesday, the 8th day of March, 1905.

By order, GEORGE WEBB, Town Clerk.

GREAT NORTHERN RAILWAY COMPANY (IRELAND).

The Directors are prepared to receive TENDERS for the SUPPLY of 3,000 TONS of 92lb. STEEL BULLHEAD RAILS, with the necessary Fish-plates, and 2,000 TONS of CAST IRON CHAIRS.

Specifications and forms of Tender can be obtained from the Secretary on payment of 1s. each.

Tenders should be delivered to the undersigned not later than 10 a.m. on Monday, the 6th March, 1905.

The Directors do not bind themselves to accept the lowest or any Tender.

T. MORRISON,
Secretary.

Secretary's Office:
Amiens Street Terminus, Dublin,
February 15th, 1905.

THE CORPORATION OF GREAT YARMOUTH.

ELECTRIC LIGHTING.

The Corporation of Great Yarmouth invite TENDERS for the supply and delivery of:

Section 1. TWO WATER-TUBE BOILERS.
Section 2. 300 kw. STEAM ALTERNATORS.

Copies of the Specifications, with general conditions and forms of Tender, may be obtained at the offices of Messrs. PREECE AND CARDEW, 8, Queen Anne's Gate, Westminster, S.W., upon payment of One Guinea for each section, which will be returned on receipt of a *bonâ fide* Tender.

Extra copies of the Specification can be obtained upon payment of 5s. each copy, which will not be returnable.

Sealed Tenders, endorsed "Electric Lighting," must be delivered at the Town Hall not later than 12 noon on Wednesday, March 1st, 1905.

The Corporation do not bind themselves to accept the lowest or any Tender.

By order,
EDGAR STEPHENS,
Town Clerk.

Town Hall, Great Yarmouth,
February, 1905.

HULL CORPORATION.

TO CABLE MANUFACTURERS.

The Electric Lighting Committee of the Hull Corporation are prepared to receive TENDERS for the supply, &c., of MAINS and CABLES for a period of twelve months.

Specifications and forms of Tender may be obtained from the City Treasurer, Town Hall, Hull, on payment of a deposit of One Guinea in respect of each Specification demanded (cheques and postal orders to be made payable to Mr. T. G. Milner, City Treasurer), and deposits will be returned on receipt of a *bonâ fide* Tender.

The Corporation do not bind themselves to accept the lowest or any Tender.

Tenders, sealed and endorsed "Tender for Mains," to be addressed to the Chairman of the Electric Lighting Committee, and to be delivered at the Town Clerk's Office, Town Hall, Hull, not later than 12 noon on Wednesday, March 1st, 1905.

H. BELL,
City Electrical Engineer.

Electric Light Station, Sculcoates Lane,
February 13th, 1905.

APPOINTMENTS OPEN.

CITY OF LEEDS.—THE CORPORATION

require the services of a fully qualified and experienced WATERWORKS ENGINEER, with special experience in the construction of waterworks, to take the supervision and management of the construction of new reservoirs in the Burn and Laver Valleys in Yorkshire, and also of the existing waterworks system of the Corporation. Salary, £1,000 per annum.

Applications, with three copies of testimonials, and endorsed "Water Engineer Application," to be sent to the undersigned not later than February 28th, 1905.

Canvassing members of the Corporation, directly or indirectly, is prohibited.

ROBERT E. FOX,
Town Clerk.

COUNTY BOROUGH OF NORTHAMPTON.

BOROUGH ENGINEER AND SURVEYOR'S DEPARTMENT.

The CORPORATION invite APPLICATIONS for the appointment of SECOND ENGINEERING ASSISTANT in the Borough Engineer and Surveyor's Office at a commencing salary of £100 per annum, rising by annual increments of £10 per annum to a maximum of £130 per annum.

Candidates must have had good general experience in municipal and sanitary engineering. Preference will be given to Candidates between the ages of 24 and 28 years.

Applications, stating age and qualifications, in Candidate's own handwriting, accompanied by copies of not more than three recent testimonials, must be endorsed "Second Engineering Assistant," and delivered at the Borough Engineer's Office not later than noon on Tuesday, the 28th instant.

Canvassing, directly or indirectly, will disqualify.

HERBERT HANKINSON,
Town Clerk.

Guildhall, Northampton,
February 13th, 1905.

BUYERS' DIRECTORY.

NOTE.—*The display advertisements of the firms mentioned under each heading can be found readily by reference to the Alphabetical Index to Advertisers on pages 23 and 25.*

In order to assure fair treatment to advertisers, each firm is indexed under its leading speciality ONLY.

Advertisers who prefer, however, to be entered under two or more different sections can do so by an annual payment of 5s. for each additional section.

Artesian Well Machinery.
John Z. Thom, Patricroft, Manchester.

Belting.
Binney & Son, Catherine Street. City Road, London, E.C.
Fleming, Birkby & Goodall, Ltd., West Grove, Halifax.
Gilmour, W. & O., St. John's Hill, Edinburgh.
Rossendale Belting Co., Ltd.. 10, West Mosley Street, Manchester.

Boilers.
Clayton, Son & Co., Ltd., Leeds City Boiler Works, Leeds.
Grantham Crank & Iron Co., Ltd., Grantham.
John Thompson, Wolverhampton.

Boilers (Water-tube).
Babcock & Wilcox, Ltd., Oriel House, Farringdon Street, London, E.C.
Cochran & Co. (Annan), Ltd., Annan, Scotland.
Hartley & Sugden, Ltd., Halifax.

Bolts, Nuts, Rivets, etc.
Herbert W. Periam, Ltd., Floodgate Street Works, Birmingham.
T, D. Robinson & Co., Ltd., Derby.

Books.
Crosby Lockwood & Son, Stationers' Hall Court, London, E.C.
Griffin, Charles, & Co., Exeter Street, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.
Spon, E. & F. N., 125, Strand, W.C.

Cables.
St. Helen's Cable Co., Ltd., Warrington, Lancashire.

Case-Hardening Compounds.
Hy. Miller & Co.. Millgarth Works, Leeds.

Catalogues, Printing, &c.
Atlantic Press, Ltd., Weymouth Street, Manchester.
Southwood, Smith & Co., Ltd., Plough Court, Fetter Lane, London, E.C.
Spottiswoode Advertising Agency, 8, New Street Square, E.C.

Chucks.
Fairbanks Co., 78-80, City Road, London, E.C.

Cisterns, Tanks, &c.
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Clutches (Friction).
David Bridge & Co., Castleton Ironworks, Rochdale, Lancashire.

Colliery Plants.
Graham, Morton & Co., Ltd., Leeds.

Condensing Plant.
Concentric Condenser, Ltd., 23, Northumberland Avenue, London, W.C.
Mirrlees-Watson & Co., Ltd., Glasgow.

Condensed Water Purifiers.
Lassen & Hjort, 52, Queen Victoria Street, London, E.C.

Consulting Engineers.
Gibbs, John, & Son, 80, Juke Street, Liverpool.
G. H. Hughes, A.M.I.M.E., 97, Queen Victoria Street, London, E.C.
Melville & Macalpine, 615, Walnut Street, Philadelphia, Pa,, U.S.A.

Continental Railway Arrangements.
South Eastern & Chatham Railway Co.

Conveying and Elevating Machinery.
Adolf Bleichert & Co., Leipzig-Gohlis, Germany.
Brown Hoisting Machinery Co.. 39, Victoria Street, London, S.W.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Graham, Morton & Co., Ltd., Leeds.
Temperley Transporter Co., 72, Bishopsgate Street Within, London, E.C.

Coverings (Boiler).
Magnesia Coverings, Ltd., Washington Station, co. Durham.

Cranes, Travellers, Winches, etc.
Joseph Booth & Bros. Ltd, Rodley, Leeds.
Thomas Broadbent & Sons, Ltd., Huddersfield.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Cranks.
Clarke's Crank & Forge Co., Ltd., Lincoln, England.

Cutters (Milling).
E. G. Wrigley & Co., Ltd., Foundry Lane Works, Soho, Birmingham.

Destructors.
Heenan & Froude, 4, Chapel Walks, Manchester.
Horsfall Destructor Co., Ltd., Armley, Leeds.

Dredges and Excavators.
Delange & Cie, Mce., Hoboken, near Antwerp.
Rose, Downs & Thompson, Ltd., Old Foundry, Hull.

Economisers.
E. Green & Son, Ltd., Manchester.

Ejectors (Pneumatic).
Hughes & Lancaster, 47, Victoria Street, London, S.W.

Electrical Apparatus.
Allgemeine Elektricitäts Gesellschaft, Berlin, Germany.
Broadbent, T. W., Victoria Electrical Works, Huddersfield.
Crompton & Co., Ltd., Arc Works, Chelmsford.
Crypto Electrical Co., 3, Tyer's Gateway, Bermondsey Street, London, S.E.
Gent & Co., Ltd., Faraday Works, Leicester.
Greenwood & Batley, Ltd.. Albion Works, Leeds.
India Rubber, Gutta Percha, and Telegraph Works Co., Ltd., The Silvertown, London, E.
Mather & Platt, Ltd., Salford Iron Works, Manchester.
Matthews & Yates, Ltd., Swinton, Manchester.
Mix and Genest, Berlin, W., Germany.
Nalder Bros. & Thompson, 34. Queen Street, London, E.C.
Newton Brothers, Full Street, Derby.
Phœnix Dynamo Manufacturing Co., Bradford, Yorks.
Simplex Steel Conduit Co., Ltd., 20, Bucklersbury, London, E.C.
Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.
Turner, Atherton & Co., Ltd., Denton, Manchester.
B. Weaver & Co., 22, Rosoman Street, Clerkenwell, London, E.C.

Engineers' Supplies.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne

Engines (Locomotive).
Baldwin Locomotive Works, Philadelphia, Pa., U.S.A
Hunslet Engine Co., Ltd., Leeds, England.
Hudswell, Clarke & Co., Ltd., Leeds, England.

Engines (Stationary).
Allis-Chalmers Co., 533, Salisbury House Finsbury Circus, London, E.C.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Mirrlees Watson Co., Ltd., Glasgow.
Soest, L., & Co., Ltd., 114-116, Victoria Street, London, S.W.

Engines (Traction).
Jno. Fowler & Co. (Leeds), Ltd., Steam Plough Works, Leeds.
Garrett & Sons, Ltd., Richard, Leiston, R.S.O., Suffolk.

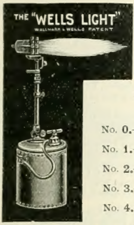
Engravers.
Jno. Swain & Son, Ltd., 58, Farringdon Street, London, E.C.

Exhaust Steam Oil Separators.
Lassen & Hjort, 52, Queen Victoria Street, London, E.C,

Fans, Blowers.
Capel Fan Co., 13. Moseley Street, Newcastle-on-Tyne.
Davidson & Co., Ltd., "Sirocco" Engineering Works, Belfast, Ireland.
Gibbs, John & Son, 80, Juke Street, Liverpool.
James Keith & Blackman Co., Ltd., 27, Farringdon Avenue, London E.C.
Matthews & Yates, Ltd., Swinton, Manchester.

Fire Bricks.
J. H. Sankey & Son, Ltd., Essex Wharf, Canning Town, London, E.
E. J. & J. Pearson, Ltd., Stourbridge.

PAGE'S WEEKLY Wells' Specialities



PORTABLE LIGHT FROM OIL

UP TO 4,000 CANDLE POWER.

Adopted by 26 Governments and all Leading Firms. Over 17,000 sold. Over 1,500 supplied to British and Foreign Railways.

EACH LAMP GUARANTEED.

Horizontal Flame Unaffected by Weather.

	PRICE COMPLETE.
No. **0.**—500 Candles, small hand pattern, for petroleum	£7 7 0
No. **1.**—1,500 Candles, hand pattern, with No. 2 size burner for Tar Oil ...	£10 0 0
No. **2.**—1,500 or 2,000 Candles, useful and portable pattern	£15 10 0
No. **3.**—2,500 or 3,500 Candles, Manchester Ship Canal pattern ...	£16 10 0
No. **4.**—3,500 or 4,000 Candles. A most powerful lamp	£17 15 0

These Lamps are arranged to burn Kerosene or Petroleum when sent to Foreign Countries; but in Great Britain our Special Wells Oil is supplied, which is half the price, and gives 30 per cent. more light. Special prices for our oil may be had on application to our Agents or direct to us.

For Electrical Engineers, Contractors, Builders, Docks, Railways, &c.

This Lamp will not blow out in a high wind, produces a clear white light of about 200 candle power, from ordinary paraffin or petroleum. The tank holds 1½ gallons of oil, burning six hours.

Price **£3** each.

Extra Burners **3/-** each.

WELLS' STANDARD"
OIL GAS LAMP NO 50

WELLS' OIL GAS GENERATING LAMP No. 40.

Weight, 10 lb. Capacity, 7 pints. Burning about 7 hours.

Made in Sheet Steel, with top and bottom of our "Unbreakable" Metal, for Lightness and Strength, with large Capacity.

Price, with Single Burner...	**16**/-	each.
,, Double ,, ...	**19**/-	,,
Tripod Stands	**3**/-	,,
Extra Burners	**2**/-	,,

A. C. WELLS & Co.,

100a, Midland Road, St. Pancras,
LONDON, N.W.

WELLS' "LIGHTNING PAINTER."

(WALLWORK AND WELLS' PATENTS.)

PAINTING BY MACHINE.

Great Saving in Time, Paint, and Labour.

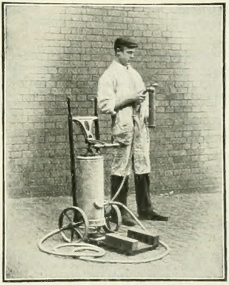
PAINTING SPEED—3 square yards a minute.

The paint is sprayed evenly and continuously through a flexible tube and nozzle supplied with compressed air, either from existing air main or from our special Compressors.

No. 1 Painter (as above Illustration) ...	£25 0 0
No. 2 ,, ...	£30 0 0
No. 3 ,, ...	£35 0 0
Single Air Compressor	£17 10 0
Double Air Compressor	£27 0 0

HAND AIR COMPRESSORS,

Paint Holder and Sprayer Combined.



Invaluable for ELECTRICAL WORK, STENCILLING, ORNAMENTING, DECORATING, &c.,

or any class of painting where the work is not very heavy or continuous.

Price, Complete £16

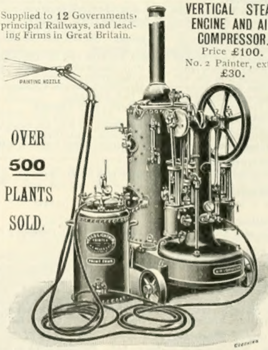
Hand Sprayer and Hose supplied separately, £9.

Supplied to **12** Governments, principal Railways, and leading Firms in Great Britain.

VERTICAL STEAM ENGINE AND AIR COMPRESSOR.

Price **£100.**

No. 2 Painter, extra **£30.**



OVER 500 PLANTS SOLD.

Buyers' Directory—(*Continued*).

Firewood Machinery.
M. Glover & Co., Patentees and Saw Mill Engineers, Leeds.

Fountain Pens.
Mabie, Todd & Bard, 93, Cheapside, London, E.C.

Forging (Drop) Plants.
Brett's Patent Lifter Co., Ltd., Coventry.

Forgings (Drop).
J. H. Williams & Co., Brooklyn, New York, U.S.A.

Furnaces.
Deighton's Patent Flue & Tube Company, Vulcan Works, Pepper Road, Leeds.
Leeds Forge Co., Ltd., Leeds.
W. F. Mason, Ltd., Engineers, Manchester.

Gas Producers.
Graham, Morton & Co., Ltd., Leeds.
W. F. Mason, Ltd., Engineers, Manchester.
Power-Gas Corporation, Ltd., 39, Victoria Street, London, S.W.

Gauge Glasses.
J. B. Treasure & Co., Vauxhall Road, Liverpool.

Gauges.
Klinger, Richard & Co., 66, Fenchurch Street, London, E.C.

Gearing.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.
Hamilton & Co., J. B., 145, Cannon Street, E.C
Wild, M. B., & Co., Corporation Street, Birmingham.

Gold Dredging Plant.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Greases.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.

Hammers (Steam).
Davis & Primrose, Leith Ironworks, Edinburgh.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Hoisting Machinery.
See Conveying Machinery.

Horizontal Boring Machines.
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Hydraulic Leather.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Icemaking and Refrigerating Machinery.
H. J. West & Co., 114-118, Southwark Bridge Road, London, S.E.

Indicators.
Dobbie McInnes, Ltd., 41 & 42, Clyde Place, Glasgow.
Hannan & Buchanan, 75, Robertson Street, Glasgow.

Iron and Steel.
Askham Bros. & Wilson, Ltd., Sheffield.
Consett Iron Co., Ltd., Consett, Durham, and Newcastle-on-Tyne.
Fairley & Sons, James, Old Mint, Shadwell Street, Birmingham.
Farnley Iron Co., Ltd., Leeds England.
Fried. Krupp, Grusonwerk, Magdeburg-Buckau, Germany.
Hadfield's Steel Foundry Co., Ltd., Sheffield.
J. Frederick Melling, 14, Park Row, Leeds, England.
Parker Foundry Co,, Derby.
Purden, John & Sons, Lambhill Forge, by Maryhill Glasgow.
Walter Scott, Ltd., Leeds Steel Works, Leeds, England.
Gilbert Thompson & Co., 116, Victoria Street, London, S.W.

Ironwork (Constructional).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Ironwork (Galvanised).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Jointing Materials.
Richard Klinger & Co., 66, Fenchurch Street, London, E.C.

Lagging Sheets.
Zeitz & Co., 21, Lime Street, London, E.C.

Lathes.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Leckenby, Benton, & Co., Perseverance Ironworks, Halifax.
Mitchell, D., & Co., Ltd., Central Ironworks, Lawkholme, Keighley.
Northern Engineering Co. (1900) Ltd., King Cross, near Halifax.

Laundry Machinery.
W. Summerscales & Sons, Ltd., Engineers, Phœnix Foundry, Keighley, England.

Lifts.
Waygood & Co., Ltd., Falmouth Road, London, S.E.

Lubricants.
Blumann & Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Reliance Lubricating Oil Co., The, 19 & 20, Water Lane, Great Tower Street, London, E.C.
Matthew Wells & Co., Hardman Street Oil Works, Manchester.

Machine Tools.
George Addy & Co., Waverley Works, Sheffield.
Bateman's Machine Tool Co., Hunslet, Leeds.
Hy. Berry & Co., Ltd., Leeds.
Bertrams, Ltd., St. Katherine's Works, Sciennes, Edinburgh.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Breuer, Schumacher & Co., Ltd., Kalk, near Cologne-on-Rhine (Germany).
Britannia Engineering Co., Ltd., Colchester, England.
C. W. Burton Griffiths and Co., 1, 2, & 3, Ludgate Square, Ludgate Hill, London, E.C.
Chas. Churchill & Co., Ltd., 9-15, Leonard Street, London, E.C.
Cunliffe & Croom, Ltd., Broughton Ironworks, Manchester.
Greenwood & Batley, Ltd., Leeds.
Jones & Lamson Machine Co., 97, Queen Victoria Street, London, E.C.
John Lang & Sons, Johnstone, near Glasgow.
Luke & Spencer, Ltd., Broadheath, Manchester.
Mitchell, D., & Co., Ltd., Central Ironworks, Lawkholme, Keighley.
Jos. C. Nicholson Tool Co., City Rd. Tool Wks., Newcastle-on-Tyne.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Noble & Lund Ltd., Felling-on-Tyne.
Northern Engineering Co., 1900, Ltd., King Cross, near Halifax.
J. Parkinson & Son, Canal Ironworks, Shipley, Yorkshire.
C. Redman & Sons, Halifax.
Rice & Co. (Leeds), Ltd., Leeds, England.
G. F. Smith, Ltd., South Parade, Halifax.
John Stirk & Sons, Halifax.
Taylor and Challen, Ltd., Derwent Foundry, Constitution Hill, Birmingham.
H. W. Ward & Co., Lionel Street, Birmingham.
T. W. Ward, Albion Works, Sheffield.
West Hydraulic Engineering Co., 23, College Hill, London, E.C.
Whitman & Barnes Manufacturing Co., 149, Queen Victoria Street, London, E.C.
Winn, Charles. & Co., St. Thomas Works, Birmingham.
Yorkshire Machine Tool and Engineering Works, Liversedge, Yorks.

Marks.
Pryor, Edward, & Son, 68, West Street, Sheffield.

Metals.
Delta Metal Co., Ltd., 110, Cannon Street, London, E.C.
Magnolia Anti-Friction Metal Co., Ltd., of Great Britain, 49, Queen Victoria Street, London, E.C.
Phosphor Bronze Co., Ltd., Southwark, London, S.E.

Metals (Perforated).
W. Barns & Son, Chalton Street, Euston Road, London, N.W.

Mining Machinery.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Office Appliances.
Halden & Co., J., 8, Albert Square, Manchester.
Hall & Co., B. J., 39, Victoria Street, London, S.W.
Lyle Co., Ltd., Harrison Street, Gray's Inn Road, London, W.C.
Rockwell-Wabash Co. Ltd., 69, Milton Street, London, E.C.
Shannon, Ltd., Ropemaker Street, London, E.C.
Titan Binder Co., 31, Queen Victoria Street, London, E.C.
Trading and Manufacturing Co., Ltd., Temple Bar House, Fleet Street, London, E.C.

Oils, &c.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Wells, M., & Co., Hardman Street Oil Works, Manchester.

Packing.
Beldam Packing & Rubber Co., 93-94, Gracechurch Street, London E.C.
Frictionless Engine Packing Co., Ltd., Hendham Vale Works, Harpurhey, Manchester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.
Redfern & Co., S., Swan Lane, New Brown Street, Manchester.
Quaker City Rubber Co., Coronation House, Lloyd's Avenue, E.C.
United Kingdom Self-Adjusting Anti-Friction Metallic Packing Syndicate, 14, Cook Street, Liverpool.
United States Metallic Packing Co., Ltd., Bradford,
J. Bennett von der Heyde, 6, Brown Street, Manchester.

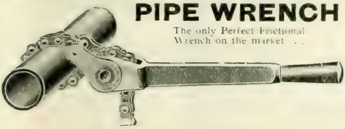
Paint (Metallic).
Metallic Paint Co., Ltd., Cardiff.

Paper.
Lepard & Smiths, Ltd., 29, King Street, Covent Garden, London, W.C

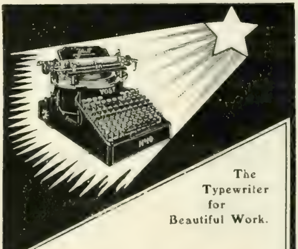
Patent Agents.
Page & Rowlingson, 28, New Bridge Street, London, E.C.

PAGE'S WEEKLY Miscellaneous

THE
JOS. C. NICHOLSON TOOL CO.
Machine Tool Makers, NEWCASTLE-ON-TYNE.
Sole Proprietors and Makers of
The "BEAR" Patent Smooth Grip
PIPE WRENCH
The only Perfect Frictional Wrench on the market . .



EFFICIENCY
IS THE
KEYNOTE
OF OUR
ESTABLISHMENT
☞ PROVE IT BY A VISIT.
JOHN LANG & SONS,
Johnstone, near GLASGOW.



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Typewriter
for
Beautiful Work.

YŌST

SWIFT, QUIET, & CONVENIENT.
Made of Best Materials only.

ILLUSTRATED BOOKLET POST FREE

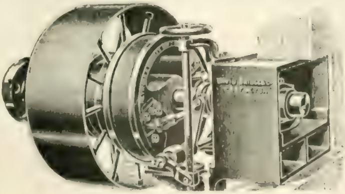
THE YŌST TYPEWRITER CO., Limited,
50, Holborn Viaduct London, E.C.

FOR THE BEST BOOKS BEARING ON THE INDUSTRIES DEALT WITH IN "PAGE'S WEEKLY," viz., ENGINEERING, ELECTRICAL, IRON AND STEEL, MINING AND SHIPBUILDING, ASK FOR CATALOGUE, CHARLES GRIFFIN & CO., LTD., 12, EXETER STREET, STRAND, LONDON, AND SEE SPECIAL ADVERTISEMENT ALTERNATE WEEKS.

PLAN-COPYING PAPERS and LINENS.
White Lines on Blue Ground; Blue Lines on White Ground; Black Lines on White Ground.
PRICE LIST ON APPLICATION.
New Catalogue in the Press. Price 1s., post free.
MANUFACTURERS OF PHOTOGRAPHIC DRY PLATES, PAPERS, MOUNTS, CAMERAS, AND SUNDRIES.
MARION & Co., Ltd., 22, 23, Soho Square, London, W

HEYWOOD & BRIDGE'S **PATENT FRICTION CLUTCH** and SHAFT COUPLING

WE MAKE
CLUTCHES,
SHAFTING,
GEARING and
HAULING
INSTALLATIONS
A SPECIALTY.
Sixty Page Work Free.
DON'T MISS THIS



Patentees and Sole Makers:
DAVID BRIDGE & CO.,
Castleton Iron Works,
ROCHDALE, LANCS.
London Office
35, Queen Victoria Street,
E.C.

Buyers' Directory—(*Continued*).

Photo Copying Frames.

J. Halden & Co., 8, Albert Square, Manchester
B. J. Hall & Co., 30, Victoria Street, London, S.W.

Photographers.

Booker & Sullivan, 67 and 69, Chancery London, W.C.
Elliott & Fry, 55, Baker Street, London, W.

Photographic Apparatus.

Marion & Co., Ltd., 22, 23, Soho Square, London, W.

Pinch Bars.

Samson & Co., Garforth, near Leeds.
Stone & Co., J. B., 135, Finsbury Pavement, London, E.C.

Pistons.

Lancaster & Tonge, Ltd., Pendleton, Manchester.

Planished Sheets.

Zeitz & Co., 21, Lime Street, London, E.C.

Porcelain.

Gustav Richter, Charlottenburg, near Berlin, Germany.

Presses (Hydraulic).

Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Publishers.

Crosby Lockwood & Son, 7, Stationers' Hall Court, London, E.C.
Charles Griffin & Co., Ltd., Exeter Street, Strand, London, W.C.
Spon, E. and F. N., 125, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.

Pumps and Pumping Machinery.

Drum Engineering Co., 27, Charles Street, Bradford.
Enke, Carl, Schkeuditz-Leipzig, Germany.
Fairbanks, Morse & Co., 126, Southwark Street, London, S.E.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
J. P. Hall & Sons, Ltd., Peterborough.
Hathorn, Davey & Co., Ltd., Leeds, England.
Positive Rotary Pumps, Ltd., 23, Northumberland Avenue, London, W.C.
Tangyes, Ltd., Cornwall Works, Birmingham.

Radial Drilling Machines.

Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Northern Engineering Co. (1900), Ltd., King Cross, near Halifax

Rails.

Wm. Firth, Ltd., Leeds.

Railway Wagons.

Nye, A. W., 110, Cannon Street, London, E.C.
W. R. Renshaw & Co., Ltd., Phœnix Works, Stoke-on-Trent.

Riveted Work.

F. A. Keep, Juxon & Co., Forward Works, Barn Street, Birmingham.

Roofs.

D. Anderson & Son, Ltd., Lagan Felt Works, Belfast.
Graham, Morton & Co., Ltd., Leeds.
Head, Wrightson & Co., Ltd., Thornaby-on-Tees.

Ropeways (Aerial).

Bullivant & Co., Ltd., 72, Mark Lane, London, E.C.

Scientific Instruments.

Cambridge Scientific Instrument Co., Ltd., Cambridge.

Stampings.

Thos. Smith's Stamping Works, Ltd., Coventry.
Thomas Smith & Sons of Saltley, Ltd., Birmingham.

Stamps (Rubber).

Rubber Stamp Co., 1 & 2, Holborn Buildings, Broad Street Corner, Birmingham.

Stamps (Metal).

Edward Pryor & Son, 68, West Street, Sheffield.

Steam Traps.

British Steam Specialties, Ltd., Fleet Street, Leicester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Steam Wagons.

Thornycroft & Co., Ltd., J. I., Chiswick, London, W.
Yorkshire Patent Steam Wagon Co., Pepper Road, Hunslet, Leeds.

Steel Tools.

Saml. Buckley, St. Paul's Square, Birmingham.
Pratt & Whitney Co., 23-25, Victoria Street, London, S.W.

Stokers.

Ed. Bennis & Co., Ltd., Bolton, Lancs.
Meldrum Brothers, Ltd., Atlantic Works, Manchester.

Stone Breakers.

S. Pegg & Son, Alexander Street, Leicester.

Superheaters.

A. Bolton & Co., 40, Deansgate, Manchester.

Time Recorders.

Howard Bros., 10, St. George's Crescent, Liverpool, and 100c, Queen Victoria Street, London, E.C.
International Time Recording Co., 171, Queen Victoria Street, London, E.C.

Tubes.

Premier Boiler Tubes, Ltd., 28, Victoria Street, London, S.W.
Thomas Piggott & Co., Ltd., Spring Hill, Birmingham.
Tubes, Ltd., Birmingham.

Turbines.

G. Gilkes & Co., Ltd., Kendal.
Greenwood & Batley, Albion Works, Leeds.
S. Howes, 64, Mark Lane, London, E.C.

Typewriters.

Elliott-Fisher Co., 85, Gracechurch Street, London, E.C.
Empire Typewriter Co., 77, Queen Victoria Street, London, E.C.
Yost Typewriter Co., 50, Holborn Viaduct, London, E.C.

Valves.

Holmes & Co., W. C., Huddersfield.
Scotch and Irish Oxygen Co., Ltd., Rosehill Works, Glasgow
Shaw, Joseph, Albert Works, Huddersfield.
Winn, Charles, & Co., St. Thomas Works, Birmingham.

Ventilating Appliances.

Matthews & Yates, Ltd., Swinton, Manchester.

Wagons—Steam.

Thornycroft & Co., J. I., Ltd., Chiswick, London, W.

Water Softeners.

Lassen & Hjort, 52, Queen Victoria Street, London, E.C.

Weighing Apparatus.

W. T. Avery & Co., Soho Foundry, Birmingham, England
Samuel Denison & Son, Hunslet Moor, near Leeds.
Graham, Morton & Co., Ltd., Leeds.

Wells Light.

A. C. Wells & Co., 100A, Midland Road, St. Pancras, London, N.W.

Wind and Water Supply Machinery.

Eric S. A. Smith, Bridlington.

Wire Working Machinery.

Ed. Brand, 35, Shakespeare Street, Manchester.

"Woodite."

"Woodite" Company, Mitcham, Surrey

BULLIVANTS'

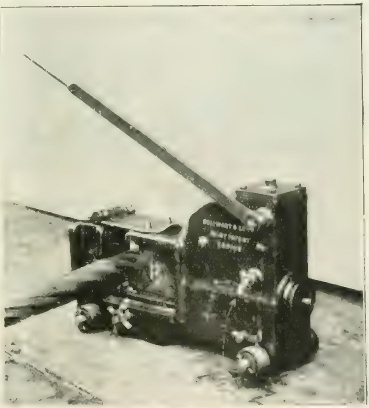
Steel Wire Mining Ropes.

Wire Ropes for Hauling and Winding Gear,
and all operations connected with Mining.

CRANE ROPES,

LIFT ROPES,

HAULING ROPES,



BLOCKS,

PULLEYS,

CRAB WINCHES,

AND ALL

WIRE ROPE APPLIANCES.

Patent Hydraulic Rope Cutting Machine SELBY PATENT.

With this Machine a man can cut up to 9-in. circ. wire rope
without assistance in about one minute.

RAPID. SIMPLE. PORTABLE. LABOUR SAVING.

Price and all Particulars on application to Sole Manufacturers :—

BULLIVANT & CO., Ltd., Works MILLWALL, E.

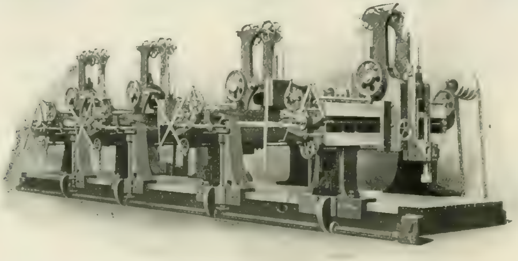
Telephone No. : 239 EASTERN.

PAGE'S WEEKLY Machine Tools

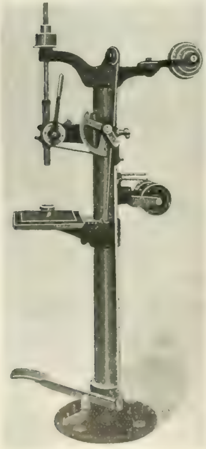
JOHN STIRK & SONS,

MACHINE TOOL MAKERS,

(Established 1866.) HALIFAX.



Locomotive Frame-plate Slotting Machine (85 tons).



OUR No. 7

SENSITIVE DRILL

HAS MANY GOOD POINTS,

ONE BEING A

Satisfactory Pedal Feed.

J. PARKINSON
& SON,
SHIPLEY,
England.

Cables: "TEMPLES, SHIPLEY."

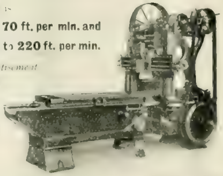
BATEMAN HIGH-SPEED PLANERS

The Machine illustrated is

Cutting at 60 to 70 ft. per min. and Returning at 200 to 220 ft. per min.

See our half page Advertisement alternate week.

BATEMAN'S MACHINE TOOL CO., Ltd.,
Hunslet,
LEEDS.



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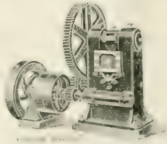
BERTRAMS LIMITED



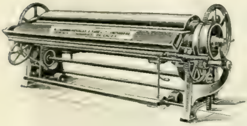
Angle Iron Cutter

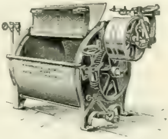
St. Katherine's Works,
Sciennes,
EDINBURGH.

London Office:
MOORGATE
STATION
CHAMBERS, E.C.

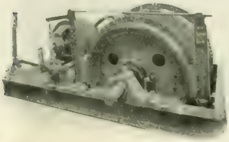
MACHINE TOOLS For Engineers, Shipbuilders, Boiler Makers, etc., etc.

PAGE'S WEEKLY Machine Tools



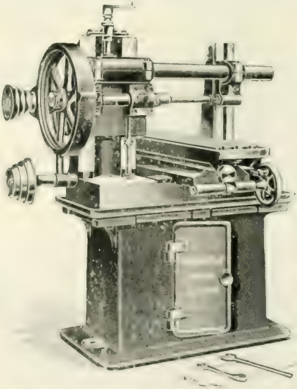


LAUNDRY MACHINERY
. AND . .
Cooking Apparatus.
CATALOGUE ON APPLICATION.
EXPERT ADVICE GIVEN.
W. Summerscales & Sons, Ltd.,
Phœnix Foundry, KEIGHLEY, ENGLAND.



Electric Hauling **GEARS**
Main and Tail, Main Rope, Endless Rope, and Portable, Hoisting, and Hauling Gears.
M. B. WILD & CO., 35 and 36, Clarence Chambers, Corporation Street, BIRMINGHAM.

HIGH-CLASS LATHES & RADIAL DRILLS.
Write for our Lists
Telegrams: "Tools, Keighley."
D. MITCHELL & CO., Ltd., Parsonage Works, KEIGHLEY.
On War Office and India Office Lists.



BRADBURY'S
Newly Designed
Standard Milling Machine
For
SPEED,
ACCURACY,
ADAPTABILITY,
IS A 1.
Prices and Particulars from - -
BRADBURY & Co., Ltd., Wellington Works, OLDHAM.

PAGE'S WEEKLY Machine Tools

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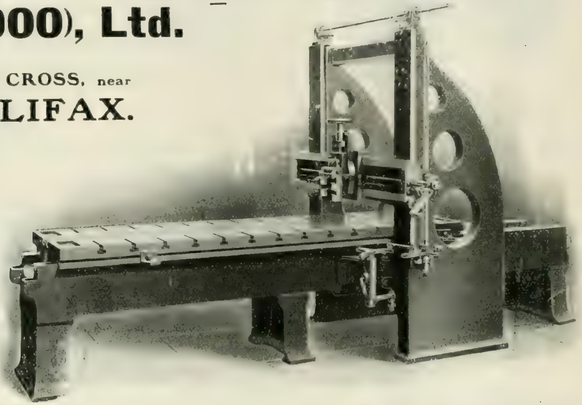
KING CROSS, near
HALIFAX.

PLANING
MACHINE,
from 2 feet
up to 8 feet
square.



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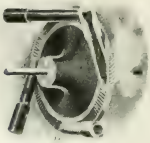
LEEDS.

Machine Tools.

Dynamos & Motors.

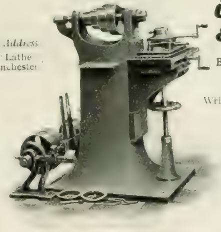
De Laval's Patent
Steam Turbines.



Tel. Address
"Lathe
Manchester"

Cunliffe & Croom, Ltd.,
Broughton Lane,
MANCHESTER.

Write for NEW. . .
List
of Tools
FOR
Brass .
Finishers.



Brass Finishers' Milling Machine.

Telegrams: "MILLING, SHEFFIELD."
National Telephone No.: 985.

For the Latest and most Up-to-Date

HEAVY = =
MACHINE
TOOLS = =

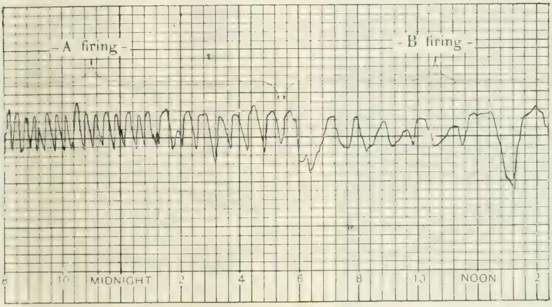
Also Special Lifting Jack for Electric Tramcars.

WRITE . . .
GEORGE ADDY & Co.,
WAVERLEY WORKS, SHEFFIELD.

PLATE BENDING MACHINE.

PAGE'S WEEKLY Miscellaneous

IT PAID FOR ITSELF IN A WEEK.



This is the statement made to us by a large firm for whom we recently installed one of our

Electrical Recording Thermometers

To control the working of an annealing furnace.

THIS RECORD was supplied to us by another firm, and shows clearly the difference in the firing of two men, A and B. Each space on the vertical scale corresponds to four Centigrade degrees.

On request, List No. 25P. will be sent free by return.

THE CAMBRIDGE SCIENTIFIC INSTRUMENT COMPANY, Ltd.,

CAMBRIDGE, ENGLAND.

Boltons' Downtake Superheater WITH DOUBLE CIRCULATION.

IMPROVED BOX AND "FIELD" TUBES. (PATENTED)

Simple and Reliable. Readily Applied. Inexpensive.

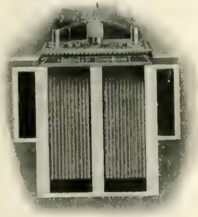
Saves 10 to 15 %

Is made of Steel throughout.

A large number working in—
Textile Mills,
Paper Works,
Collieries,
Electricity Stations,
Flour Mills, etc.

Suitable for any Working Pressure up to 200 lbs. per square inch.

Approved of by Leading Engineers and Insurance Co.'s.



REPEAT ORDERS BEING GIVEN.

PATENTEES AND SOLE MAKERS:—

A. BOLTON & CO.,

Engineers and Superheating Specialists,
49, Deansgate, MANCHESTER.

M. GLOVER & CO., LEEDS,

SAW MILL ENGINEERS.

"IDEAL" GUARDS, BENCHES, SHARPENERS, FIREWOOD, and LIGHTER PLANTS,

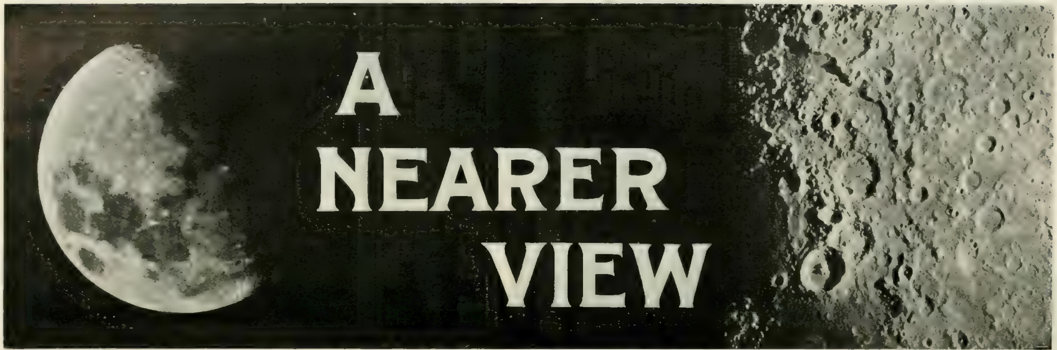
Saving in Wages alone means

A CERTAIN LARGE INCOME.

HARTNESS AUTOMATIC OPENING DIE

The most satisfactory means yet devised for the production of screw threads.

JONES & LAMSON MACHINE CO.,
JUBILEE BUILDINGS,
97, Queen Victoria Street, LONDON.



Moon's Age [illegible] days 12 hours Lick Observatory, [illegible]

Photographed by Ritchie with 10 inch Telescope

OF MOON OR PLANET
NEEDS A MORE POWERFUL TELESCOPE,

But if you want to discover the

PEOPLE WHO ARE WAITING FOR YOUR MACHINERY

There is nothing like an attractive Advertisement in a progressive paper

We have made "Page's Weekly" a Success.
We can make a Success of your Advertisement.

Rates on application to Advertising Manager,
"PAGE'S WEEKLY,"
Clun House, Surrey Street, Strand, W.C.

PAGE'S WEEKLY Systems for Engineers

Card Systems are a Business Necessity

COSTS.

The cost of production is an important feature in the counting house of every manufacturing concern, as charges and future estimates must be based on the record of such costs. Card systems, properly applied, give all this information with a minimum of clerical labour and a maximum of convenience that cannot be obtained with a book system, no matter how well devised. All the details being accessable at any time, without respect to each other, so that statistics of any kind may be gathered without difficulty or delay, using in many instances the original record and dispensing with the necessity of transcribing same.

QUOTATIONS—In and Out.

When a client refers to a quotation without indicating the date it was given; or if, when buying, it is desirable to consult quotations received, considerable difficulty is often experienced in locating the particular information desired. The card system will overcome this difficulty. By a method of cross-indexing the knowledge may be obtained either by date, name of article, or the name of the firm interested.

TRAVELLERS' RECORDS.

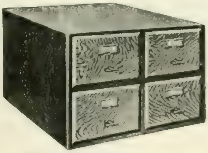
To supplement a traveller's efforts so as to help him to get all there is in his territory you must know what he is doing, who he calls on, when he is to call again, with any other details of interest. This information also enables the firm to keep in closer touch with their customers, to know if anyone is being neglected, and a new traveller can take up the work intelligently and without prejudice to his employer's interests.

STAFF RECORDS.

It is always desirable to know whom the staff consist of; where they live, where they came from, who they worked for, and various other details, for and against, of interest to their employers. The card system is particularly applicable to this purpose, as names can be filed in strict alphabetical order and are readily referred to. When anyone leaves, the name can be transferred to the past employees' file, without rewriting or scratching out the previous record, where it is accessable for reference in case of reapplication for a position or other purpose.

THIS CABINET

Properly and intelligently arranged, will contain all that information regarding the details



pertaining to a business organization which it is necessary to have accessable to that guiding hand that is to direct it on to continued success.

OVERDUE ACCOUNTS

Are the bane of the manager and the cashier, the great difficulty being to dun the slow paying accounts without hurting the feelings of an otherwise good customer. This can be successfully accomplished by the use of the card index system, with the additional advantage of having all overdue accounts together and under the eye of the man responsible for their collection. One of our clients has reduced his outstanding accounts £10,000 per year by its use, and states that the system is responsible for increased purchases by these clients. We can show you how.

CATALOGUE INDEXES.

Can you always place your hand on the particular catalogue, circular or sample sheet you want when it becomes necessary to consult same? The answer to that question is usually "No, but ." The card system will enable you to refer directly to the particular catalogue or catalogues you require, and even to the page, either by name of the firm issuing or by the article treated. The firm cards can also contain information regarding forwarding, discounts, etc.

FOLLOW-UP SYSTEMS.

How frequently orders are lost through inadequate attention is best shown by the experience of one of our clients, who stated that they secured 25% better results from their advertising through the use of the card follow-up system than they had formally secured without it. We can apply this system to your needs so that you will derive equal benefits, whether you secure your business through advertising, circularizing or by traveller

GOODS ORDERED.

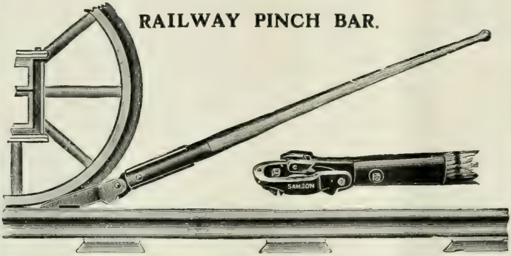
How often goods are ordered in anticipation of early use, and delivery is promised at a certain date; through lack of a proper system the date of delivery lapses without attention from the purchaser and when the goods are wanted it is found, to the inconvenience of everybody concerned, and sometimes to the financial loss of the firm, that no delivery has been made. A very simple application of the card system will overcome this difficulty and enable the user to prevent any such delays, besides permitting him to keep in closer touch with his receiving department.

ROCKWELL-WABASH Co. Ltd 69 Milton St., LONDON, E.C.
50 DEANSGATE ARCADE, MANCHESTER. 167 BUCHANAN ST., GLASGOW.

PAGE'S WEEKLY Railway Pinch Bars

The "SAMSON."

RAILWAY PINCH BAR.



A Few of the Users of the "Samson" Pinch Bars:—

Cambrian Railways.
Cork, Bandon & South Coast Railway Co.
Donegal Railway Co.
Great Northern Railway Co.
Great Southern and Western Railway Co.
London and North Western Railway Co.
Midland Railway Co.
Midland Railway Co., N.C. Committee.
Bolckow Vaughan & Co.'s Collieries.
Grassmoor Collieries.
Garforth Collieries.
Henry Briggs, Son & Co., Ltd.
Hoyland Silkstone Collieries.
Houghton Main Collieries.
J. & G. Wells' Eckington Collieries.
Micklefield Coal and Lime Co.
Mitchell Main Collieries.
Shireoaks Collieries.
Sheepbridge Co., Iron and Steel Works.
Staveley Iron and Coal Co.

The "Samson" Pinch Bar

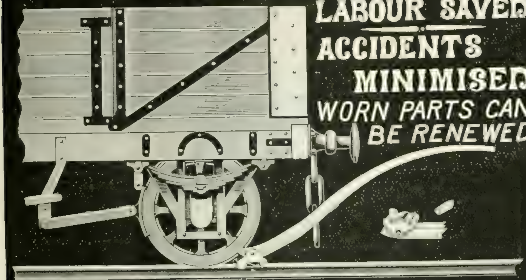
Is used as a great labour-saving tool where wagons or locomotives require moving short distances.

OUR OFFER:—

SPECIMEN BAR SENT ON SEVEN DAYS' FREE TRIAL CARRIAGE PAID BOTH WAYS.

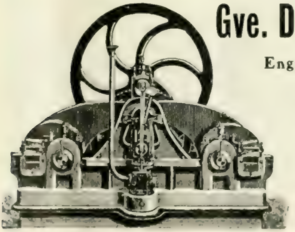
SAMSON & CO.,
Garforth, near LEEDS.

THE "EASY" CAR PUSHER (STONE'S PAT)



LABOUR SAVED
ACCIDENTS MINIMISED
WORN PARTS CAN BE RENEWED

J. B. STONE & Co. CONTRACTORS TO H.M. GOVERNMENT, RAILWAYS, ETC.
135 FINSBURY PAVEMENT LONDON. E.C.



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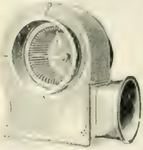
Engineering Works, HOBOKEN, near ANTWERP.

SPECIALITIES: APPLIANCES FOR PUBLIC WORKS:—Dredgers. — Elevators. — Excavators. — Tugs. — Centrifugal Pumps.—Sand Pumps.—Ballast Barges.—Lighters.—Yachts.—Hand, Steam and Hydraulic Cranes.—Drawbridges.—Pontoons.—Derricks.—Hand and Steam Winches.—Steam Engines.—Traction Engines.—Plant for Blast Furnaces.—Steel Works, Rolling Mills.—Gasholders.—Steam Hammers.—Shearing and Plate-edge Planing Machinery, &c.

Highest Award, Grand Prize, St. Louis Exhibition, 1904.



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For Induced Draught on Boilers. Heating, Cooling, Ventilating, etc.

DAVIDSON & CO., LTD.,
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115, Hope St., GLASGOW.

Sole Continental Representatives: Messrs. WHITE, CHILD, & BENEY, Ltd., 62 63, Queen St., Cheapside, LONDON, E.C.

MALLEABLE IRON & STEEL CASTINGS FOR ENGINEERS & TOOL MAKERS
TO MACHINE CLEAN & BRIGHT ALL OVER.
PARKER FOUNDRY CO. DERBY
ON ADMIRALTY LIST.

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THE ONLY PERPETUAL

LEDGER

HAVING THE LEAVES

ABSOLUTELY LOCKED IN.

WRITE "DADE" DEPT.

THE TRADING & MANUFACTURING CO., LTD.

DEVISERS OF BUSINESS SYSTEMS,

TEMPLE BAR HOUSE, FLEET STREET, LONDON, E.C.

Telegrams: "DEVISERS, LONDON."

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LONDON,
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STEAM WAGONS
PETROL CARS.

SÜDDEUTSCHE KABELWERKE A.-G., Mannheim,
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Contractors to the Imperial German Postal Authorities.

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With Paper and Air Insulation.

LEAD-COVERED CABLES
For all Tensions up to 40,000 volts.

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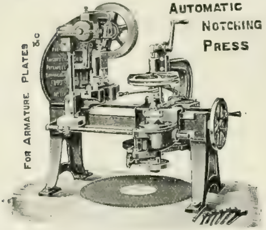

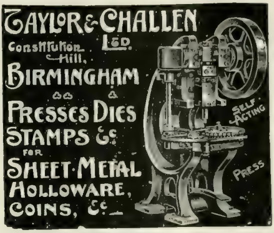

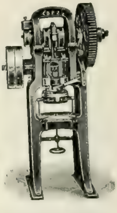

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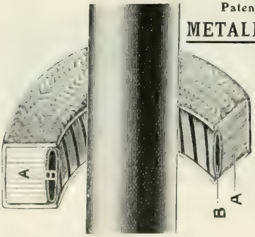

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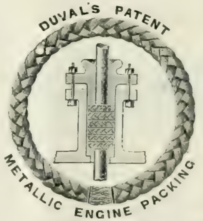

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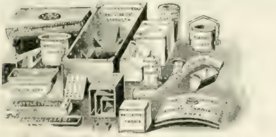

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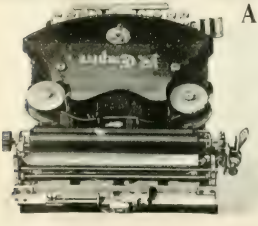

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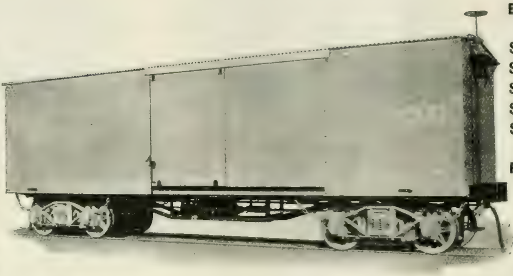

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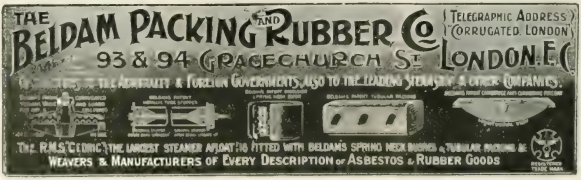

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PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

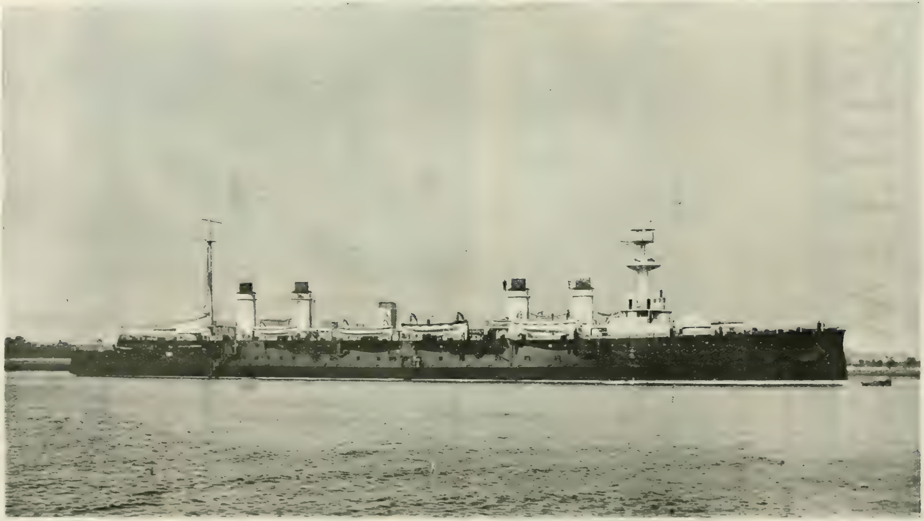
VOL. VI. LONDON, FRIDAY, FEBRUARY 24, 1905. NO 24.

The Offices of "Page's Weekly," Wednesday, Midnight.

THE question of under-ground hoisting in deep-level mines is one which is being freely discussed just now by the mining engineers of the Rand, and there appears to be not a little difference of opinion as to the best method of setting about it. The economical handling of ore in inclines sunk from an underground horizon and performing functions complementary to main vertical shafts has exercised the mind of Mr. G. A. Denny, to a considerable extent, and his conclusions recently given at a meeting of the South African Association of Engineers were entirely in favour of conveyor belts. In the majority of mines with banket reefs lying at a depth of 3,500 ft. it seems unlikely that inclinations of more than 20 deg. will have to be dealt with, while, according to Mr. Denny, the practical angle to which a conveyor belt can be run on the usual troughing idler scheme is little more than 20 deg., the maximum under the most favourable conditions being 23 deg. Schemes are on foot which contemplate the use of conveyor belts up to angles of 45 deg., but in this case before the inclination is reached a belt similar in all respects to the conveyor and travelling at the same speed, makes contact with it, causing the fragments of ore to be firmly held between the belts. Such an arrangement has been patented by Mr. B. H. Norton. Mr. Denny however, has apparently confined his attention to belts intended for the less severe gradients, and in the paper alluded to, he described a plant with three belts figured on the requirements of a 200 stamp mill, which it is assumed would require 1,600 tons of ore to be delivered at surface per day to feed it with 1,200 tons of sorted rock; plus the tonnage of waste rock, which is kept separate from the mill rock, and is separately disposed of at the surface.

MR. EDWARD PRITCHARD MARTIN.

Who has [illegible] President of the Institution of Mechanical Engineers. (See page 427.)



By courtesy of the Royal United Service Institution.]

THE NEW FRENCH FIRST-CLASS ARMOURED CRUISER "AMIRAL-GUEYDON," 9,517 TONS; 19,600 I.H.P.; SPEED, 21 KNOTS.

Armour Protection.—Water-line belt of 6 in. H.N.S., ending short way from stern in a 3·4 in. transverse bulkhead; an upper belt 3·7 in. to 2·4 in. thick, reaching just up to main deck. Turrets, 6 in. with 4 in. ammunition hoists; main deck casemates and turrets for 6·4-in. guns, 4 in.; fore conning tower, 8 in.

Armament.—Two 7·6-in. quick-firing in two turrets, one forward and one aft; four 6·4-in. quick-firing in casemates and four in turrets on upper deck; four 3·9 in. in shields; sixteen 3-pounder and six 1-pounder quick-firing guns, with two submerged torpedo-tubes.

The daily total to be dealt with by the three belts was estimated at 1,750 tons, and for this a belt 26 in. in width was proposed, capable of easily handling 70 to 80 tons per hour, at a belt speed of 250 feet per minute. Calculating the problem out on a basis of 35 tons per hour as being nearer the actual conditions, the power required was estimated at 12·5 h.p., on the maker's formulæ, and 14·5 h.p. on the general formulæ applicable to this class of problem.

There is not, according to Mr. J. A. Vaughan, a great deal of published information regarding the work performed by conveyor belts. To the Mechanical Engineers' Association of the Witwatersrand a few months ago, Mr. E. Farrar gave some interesting and instructive notes on an installation of Belt Conveyors at the Van Ryn G. M. Estate. One belt carried 142,800 lb. of rock per hour 199 ft. horizontally and raised it 48·5 ft. Power, including motor losses, = 8·11 h.p. Efficiency estimated on the vertical lift=43·12 per cent. Empty belt took 3·69 h.p. The other belt carried 177,856 lb. of rock per hour 497·5 ft. horizontally and raised it 25·5 ft. Power, including motor losses,= 8·47 h.p. Efficiency estimated on the vertical lift=7·04 per cent. The empty belt took 2·94 h.p. or perhaps 40 per cent. efficiency allowing for the driving of the travelling "tipper." Naturally there has been a good deal of discussion as to the relative strength of conveyor belts. Mr. Vaughan calculated that the belt per 1 lb. a foot has a breaking load of about 7,200 lb. Chain has a breaking load of about 6,600 lb., hemp rope, 22,000 lb., and best plough steel wire rope, say, 65,000 lb. Whereas ropes and chains need a skip or bucket to carry the load, constituting extra weight to be carried, the belt is, of course, its own bucket.

As illustrating the difficulties encountered in the use of this form of conveyor, one speaker at this meeting (Mr. A. W. K. Peirce) mentioned that at the Knight's Deep, they installed a conveyor belt for handling sands, tailings and waste rock from the sorting house, and found, operating on rock alone, the inclination of 20 degrees was a little bit steep. There was trouble when a piece of rock of a more or less symmetrical formation got on to the belt, as it was apt to roll, and it was "exciting at times." The rocks would get half way up the belt and would then start rolling down and fly off, and it was found necessary to lower the inclination a little. Other criticisms were raised by Mr. J. G. Lawn, who considered that the problem was largely a matter of angle. If the latter was fairly considerable say 20 deg., or anything above that, he thought a good many mining engineers would be satisfied with the skip as being the best appliance to use, especially as they could choose from an almost endless variety of modifications, of either continuous haulage, an endless rope, an aerial haulage. If the angle of the shaft exceeded 20 deg., he would be inclined to put in skips. At the lower angles mentioned as obtaining in some of the deep level properties of the Rand, such as 6 or 7 deg., he would be inclined to one of the endless rope systems which have been brought to such perfection in the North of England and on the Continent of Europe. For intermediate angles, a system of aerial haulage would be worth considering. Electric traction might also render useful service in this connection.

All this, however, did not convince Mr. Denny, who claimed that during the last three years mining engineers on the Rand have had a good opportunity of ascertaining the cost of maintenance and labour in connection with belt systems, and of satisfying themselves that the costs are low.

Mr. Axel Orling, whose inventions in connection with the Armstrong-Orling system of wireless telegraphy were dealt with in our issue of November 1st, 1902, is a Swede, having been born at Stockholm in 1870. This fact, as well as the part played by the young inventor in the development of wireless telegraphy, has induced our enterprising Swedish contemporary Affarsvarlden to devote considerable attention to Mr. Orling's work, and we are indebted to the editor of that journal for the accompanying photo. Mr. Orling studied in the United States under Cabot, and there constructed his electrical gas lighter. In 1890 he came over to England, and since 1895 has been associated with Mr. Armstrong, with the exception of the year 1897, when he went over to Stockholm to demonstrate an invention connected with the guiding of torpedoes. Mr. Orling has devoted a great deal of attention to the study of mechanics. His patents number not less than 150, most of them, however, being for electrical contrivances.

A [illegible] PORTRAIT OF THE SWEDISH INVENTOR MR. AXEL ORLING.

Mr. Alexander E. Outerbridge, Jun., of Messrs. William Sellers and Co., Philadelphia, has been telling the American Academy of Political and Social Science what he knows about specialisation in manufacture, and his paper, which lies before us, summarises very well the benefits of a system which has been widely adopted in America and is generally extolled. We find the manufacturer prone to select some article or product for which there is a heavy or a constant demand. He will then, by devoting himself and his capital to its development, so reduce the cost of production as to secure at least partial control of the trade. This implies a complete equipment of the most modern machinery—hence the scrap-heap which looms so largely in American industrial affairs. Mr. Outerbridge remarks that the secret of success in manufacturing lies largely in concentration of effort and the development of plant to the highest degree, so that a superior product may be turned out at a minimum cost. This will be readily conceded, but it would appear that at times even our American friends discover sundry inherent drawbacks in the plan of carrying all one's eggs in a single basket. The danger of over-production in this modern system of specialisation is one of which there have been many evidences of late. Again, to quote Mr. Outerbridge : "An establishment may have its capital tied up in a complete outfit of machinery, designed to produce one article at the lowest cost, for which there may be a constant demand at a remunerative price. Then an ingenious inventor may design a new machine, or devise a new method of manufacture, which will, perhaps, produce better goods at far lower cost, and the utility of the old plant is at once destroyed. Its costly machinery may be of little or no value for any other purpose, and so a hitherto profitable industry may be wiped out of existence at one fell swoop. This is not an imaginary statement; the author supports it by numerous facts.

PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

DAVIDGE PAGE, Editor.

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New Copy for Advertisements,

Alterations, &c., intended for insertion in the current week's issue must be delivered **not later than 4 p.m. on Monday.** If proofs are required the copy and blocks should reach us several days earlier.

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NEWS ITEMS.

At a meeting held at the Hotel Cecil under the auspices of the National Electrical Manufacturers' Association, it was decided to hold a general electrical exhibition; this will probably be held at Olympia or the Crystal Palace in October.

Mr. G. H. Stanley, A.R.S.M., the Demonstrator in Metallurgy and Surveying of Armstrong College, Newcastle-upon-Tyne, has been elected to the Professorship of Metallurgy in the Technical Institute, Johannesburg.

Mr. T. W. Sheffield, A.M.I.E.E., A.M.I.Mech.E., has favoured us with a copy of his useful and valuable paper on "Safety Devices for Electric Tramways." It is a suggestive survey, which should be in the hands of all tramway managers.

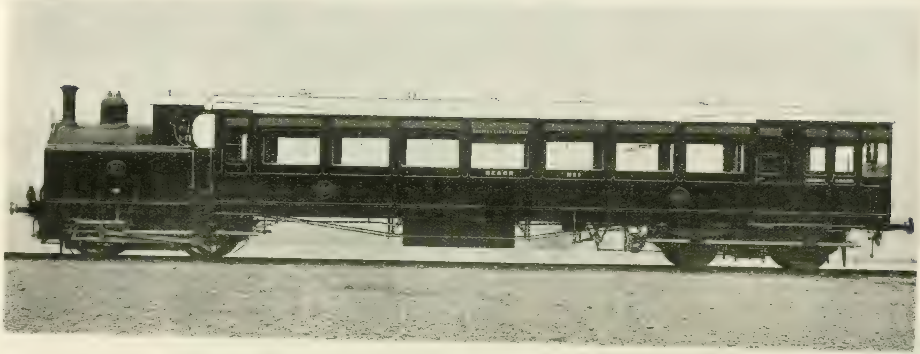
The centenary of the establishment of the works of Rylands Brothers, Ltd., wire manufacturers, of Warrington, was recently celebrated by a dinner to the employees. The business, which was founded by John and William Rylands in 1805.

We are desired to call attention to the fact that, as the new locomotive works of the Avonside Engine Company, Bristol, are practically completed, the whole of the business will be conducted from the new works, and that their address on and after February 27th, will be Avonside Engine Works, Fishponds, Bristol.

Towards a sum of £170,000, required as an establishment fund, for the new University of Sheffield, Mr. Edgar Allen has offered £10,000, if four others will subscribe £10,000 each towards the £57,000 required to complete this sum. As an alternative, he offers £5,000, if nine others will contribute a similar sum.

The Council of University College, London, in accepting with much regret the resignation of Professor L. F. Vernon-Harcourt of his office of Professor of Civil Engineering and Surveying, referred to their high appreciation of the services he has rendered to the college during his long connection with it, and to the distinction he has conferred upon the chair.

Mr. Frank McClean, the well-known engineer, made large bequests to educational bodies. To the University of Birmingham he left £5,000 to be applied in the department of physical science, and to Cambridge £5,000 to be expended in improving the instrumental equipment of the Newall Observatory. His other bequests to scientific bodies included the Royal Society, £2,000; Royal Institution, £2,000; and Royal Astronomical Society, [illegible].



NEW STEAM MOTOR CARRIAGES FOR THE SOUTH-EASTERN AND CHATHAM RAILWAY.

Built to the designs of Mr. Harry S. Wainwright, M.Inst.C.E., Chief Mechanical Engineer S.E. and C. Railway, by Messrs. Kitson and Co., of Leeds, and the Metropolitan Amalgamated Railway Carriage and Wagon Company, Ltd., Oldbury, Birmingham.

IN this type the engine is carried on a four-wheel bogie, the bogie centre pivot being fixed to a cross beam at the end of the carriage underframe; the wheel base of engine bogie measures 8 ft., and the wheels 3 ft. 7 in. diameter. The cylinders are placed outside the frames, being of 10 in. diameter by 15 in. stroke.

The boiler is of the loco type, and is fitted with a Belpaire firebox. Heating surface: Firebox, 44·5 square feet; tubes, 337 square feet; total, 381 square feet. Grate, 8·8. square feet. Working pressure, 160 lb. per square inch. Water tanks are placed at the sides and between the bogie frames. Total capacity, 400 gallons.

The coal bunkers are at the ends of side tanks, and carry about 15 cwt. The engine can be readily detached from the carriage, and can be run separately when in steam. Further details are as follows: total length over buffers is 64 ft. 11¼ in. Total weight of steam motor carriage, when unloaded, about 38 tons, distributed as follows: 24½ tons on engine bogie, and 13½ tons on carriage bogie.

The steam motor carriage is capable of taking an additional trailer carriage, weighing 16 tons, at a speed of over 35 miles per hour on a level, and an average speed, including gradients of 30 miles per hour. The car runs very smoothly, rubber being largely employed to prevent vibration. The engine coal consumption is extremely small, and economy in maintenance in several directions will, no doubt, result.

The carriage body is 45 ft. 4 in. long outside and is divided into three compartments: Third-class non-smoking, next to engine, 19 ft. 10⅜ in. long; a third-class smoking compartment, 14 ft. 10⅞ in. long; and a lugage and guard's compartment at the end 6 ft. 8 in. long.

A vestibule is placed at the end, next to the engine, also at the luggage compartment. Ordinary hinged doors, opening inwards, are placed on the side of the body, and sliding doors are arranged in the passenger and guard's compartments. The passenger compartments are finished in teak, the seats being arranged back to back, with a gangway down the centre. Seating accommodation, thirty-two non-smoking and twenty-four smoking; ventilation is provided over each window and in the roof; entrance to the car is effected by the end vestibule, leading to the non-smoking and the smoking compartments, respectively.

The car underframe is constructed of steel, and is carried at one end by a four-wheel carriage bogie, with 8-ft. wheel base, and 3-ft. 6 in. wheels; the other end of the car, which is supported on the engine bogie, is cushioned with india rubber pads. The vacuum automatic brake is provided with a hand brake on the carriage and engine in addition. The cars are fitted with Stone's system of electric lighting. The steam regulator, reversing gear, whistle, vacuum, and hand-brakes are worked by the driver from either end, and the guard can communicate with the driver by means of electric bells.

The Coal Tax.

Since Budget proposals cannot be anticipated the Chancellor of the Excnequer was able to afford little satisfaction to the influential deputation of coal miners who waited upon him at the Treasury last week to urge the removal of the Coal tax. The members were assured that their representations would receive "proper consideration," which one might presume was a foregone conclusion, but no inference was to be drawn as to the decision of the Chancellor of the Exchequer in the matter or that of the Government. The objections raised by the deputation were certainly formidable. Mr. Watts Morgan (South Wales) called attention to the large amount of distress which had existed in Glamorgan owing to colliers being out of work. He urged that the mining industry of this country might be untrammelled, since those who were engaged in it had already enough to do to meet foreign competition. One of the other speakers—Mr. J. W. Taylor, of Durham—said that in Durham and Northumberland, and particularly in the latter county, the prices of coal had fallen with the imposition of the tax, so as to make a difference of 6s. 3d. in every sovereign earned by the worker. Keen competition in the sale of coal between different countries, if not affecting the volume of trade, had a very injurious effect upon the prices realised; and as the average selling price regulated wages the worker suffered from any decrease in price. Consular reports and the Royal Commission report furnished additional arguments against the tax. The deputation hoped that Mr. Chamberlain's open mind would lead him to give the relief asked. Mr. Austen Chamberlain made it quite clear however that nothing can be stated as to the Government's propositions for the next financial year until his Budget statement is forthcoming in the House of Commons.

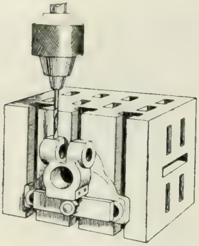
The Telephone Question.

Considerable interest has been manifested in the statement that an agreement has been made between the Postmaster-General and the National Telephone Company, Limited, for the acquisition of the business of the company by the State. It will thus be seen that another phase of what is known as the telephone question—which has already been dealt with very extensively in Page's Weekly, under the heading of Questions of the Day, has presented itself, and that an important step has been taken in the evolution of the telephone business in this country.

A Heavier Standard Rail on the North Western Railway.

Lord Stalbridge, in the course of his remarks as chairman at the half-yearly meeting of shareholders of the London and North-Western Railway Company, said he had every reason to believe that the expenses of relaying had reached the highest point and that for the future there would not be an increase. They proposed to relay with a heavier standard rail; the weight of the new rail would be 95 lb. per yard. In locomotive power considerable saving was exhibited, greatly owing to the more powerful engines which had been built, as well as, of course, to the reduced mileage of the goods trains. A large diminution was also shown in engine mileage, owing, among other causes, to the additional power of the engines, so that one engine only was required where two were needed before.

The late Mr. John Henry Austin, of the firm of John H. Austin and Co., iron and steel merchants, [illegible] and [illegible] Gracechurch Street, London, E.C., left property valued at [illegible]



NEW BOX JIG BY EDWARD G. HERBERT, LTD.

Spherical Metalic Packing.

Redford's patent metallic packing, of which a section is shown herewith, is entirely self-adjusting. It does not require a stuffing box, but can with equal facility be fixed in existing boxes. If the rod is out of alignment, the spheres move freely one within the other, in the form of a ball and socket joint, so that the special bronze anti-friction metal packing pieces endure no stresses from this cause. The illustration shows the packing fixed inside an existing stuffing box. When fixed it is fully open to view, and can be seen yielding gently to every motion of the rod, and at the same time rotating under all conditions of pressures. The only pressure on the rod is that exerted by the light springs round the bronze anti-friction metal pieces. This, the makers inform us, is only about ·5 to 1 lb. per square inch surface contact. It therefore reduces the friction to a minimum, the pressure being the same under all loads and steam pressures.

The lubrication employed keeps the rod surrounded with oil in the space left in the cover for the vibration of the rod. This oil, being away from the heat of the cylinders and steam prevents carbonisation through high temperatures and super-heated steam.

Among other advantages claimed for this arrangement are saving of oil, constant automatic lubrication of the rod, cleanly appearance, and a minimum of attention required.

The packing is manufactured by the Spherical Metallic Packing and Engineering Company, of Manchester.

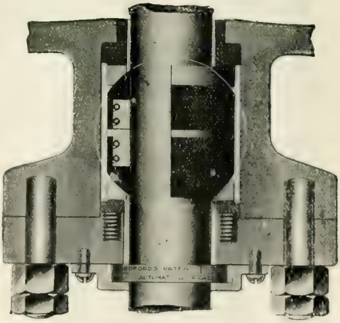
A Machine Tool Accessory.

Messrs. Edward G. Herbert, Ltd., of Manchester, have just added to their machine tool accessories a new series of Tee blocks and box jigs. One of the latter, useful adjuncts to drilling and planing machines, etc., is illustrated herewith. By the use of these jigs holes can be drilled or surfaces machined on five different sides of an object at one setting. Besides saving a number of settings, this ensures that all the holes and surfaces are square or parallel to each other.

New Cables.

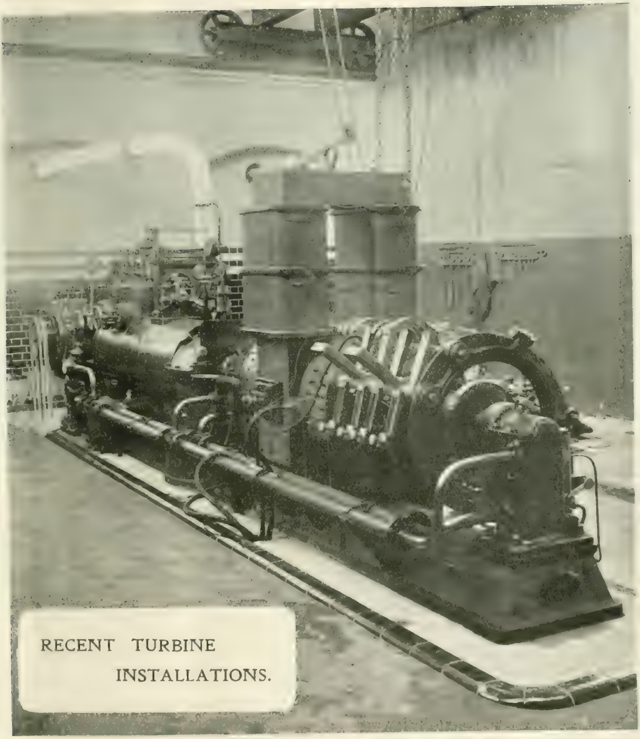
Scarcity of rubber, and the consequent high price of rubber cables, has tended to the purchase of inferior and foreign rubber cables, which, although at low cost in the first case, have frequently proved eventually to be the most expensive. Those who have in the past been compelled by competition and other circumstances to purchase such cables, will be interested to hear that Messrs. W. T. Glover and Co., Ltd., of Manchester, have now placed upon the market a second quality of low price rubber cables, which they recommend in cases where moderate insulation combined with good mechanical properties suffice, and where the conditions do not require a permanent maintenance of high elasticity of the dielectric. This second quality of cables in entitled "Non-Association." The first quality bear the familiar title "Association" cables, and are made as hitherto to the standard agreed upon by the Cable Makers' Association.

An office has been opened at 26, Victoria-street S.W., by Messrs. John M. Henderson and Co., engineers, boiler makers, and ironfounders, of Aberdeen.



REDFORD'S PATENT METALLIC PACKING

RECENT TURBINE INSTALLATIONS.



THE BRUSH PARSONS SET AT LOUGHBOROUGH ELECTRICITY WORKS.

The turbine sets are designed for an output of 250 kw. at 500 volts, the speed being 3,000 r.p.m. Both turbines exhaust into one condenser, and arrangements are also made so that if necessary the turbines can exhaust to atmosphere.

The air pump is of the "Edwards" type of the Brush Electrical Engineering Company's manufacture, and both it and the circulating pump are rope driven by motors bracketed to the wall on the engine room floor level. This is to obviate any possibility of the motors being damaged if the condenser pit were flooded. At the recent official trials the following steam consumptions at full load were obtained: the turbine at the time the test was taken was doing 252 kw., speed being 3,000 kw., steam pressure 150 lb., superheat 181 deg. F.; vacuum obtained 28·5 in., and barometer 30·25 in. Under these conditions the water consumption per kw. hour was 19·9 lb.

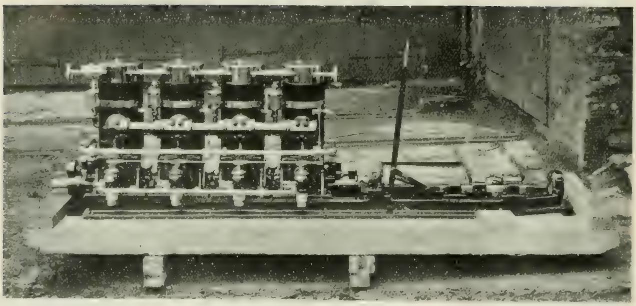


FIG. 1. FOUR-CYLINDER 14-H.P. F. AND B. MARINE MOTOR WITH REVERSING GEAR.

OLYMPIA MOTOR SHOW.

(Continued from page 346.)

MITCHAM MOTOR COMPANY.

The "F and B" marine motor is the speciality of this company. It is of the two-cycle type, and fig. 1 shows a four-cylinder 14 h.p. motor, fitted with reversing gear. A feature of the frame is that all the openings are large, making the whole of the parts accessible, while the cylinder head is water-jacketed, and is a perfect continuation of the cylinder itself, so that when it is removed the piston can be immediately withdrawn from the cylinder. The peculiar form of the inner surface of the cylinder head gives a superior firing chamber, and the cylinder is so constructed that the exhaust ports open appreciably earlier than the intake ports. A special feature is the ignitor, driven by a shaft passing through the motor shell and operated by gears. It is claimed that it gives perfect and instantaneous ignition, and that no "cranking up" is required. A speed lever has been designed to produce the spark with the piston at the top of the stroke, and facilitate advance sparking.

The ignitor plug contains the entire ignitor mechanism except the driving parts. This plug is ground into the cylinder head held in place by four nuts on four studs. If at any time it is desirable to examine the electrodes, the removal of the four nuts enables the plug to be taken out, and the spark tested, without in any way disturbing the adjustment of any of the parts. The Mitcham Company use a vaporiser of special design which operates only as the motor runs, feeding a charge with every upward stroke of the piston, and closing with every downward stroke shutting off the fuel entirely during explosion.

In the larger multi-cylinder motors a throttle is provided whereby all the vaporisers can be regulated simultaneously.

In combination with the ignitor, this throttle gives the machine a speed range which is said to render it perfectly controllable, thus overcoming one of the most serious objections to the old pattern motor. The 2-h. p. motor is claimed to have a speed range (varying with size and style of hull) of from about 9½ miles per hour down to 1 mile per hour or less, and the speed can, it is said, be adjusted from one extreme to the other without stopping the motor.

The Mitcham Company have made a special feature of standardising all parts, in order to make them interchangeable.

HOZIER ENGINEERING COMPANY.

The "Argylls" cars attracted a good deal of attention at Olympia. The exhibit consisted of five cars, a chassis, a delivery van, and several examples of detail parts showing the improvements introduced by this firm for this year.

Fig. 5 shows a 24-h.p. four-cylinder Argyll chassis. It is fitted with a new patent automatic combined carburetter and governor. This carburretter depends for its action on a supply of petrol being provided to each cylinder by a small pump operated by means of the suction of the engine itself.

The frame of the chassis is especially heavy and is made from pressed steel. The engine is hung direct from the main frame. The cylinders are cast separately. Two ignitions are provided, high tension by batteries and high tension magneto, being fitted. Both the pump and magneto are gear-driven. The commutator is placed just under the bonnet. A novel form of joint is fitted. Fig. 3 shows the knuckle joint. It is exceedingly compact and is encased from dirt. The live axle is of ample proportions and is so arranged that the gear can be readily examined without removing the axle from the car. The brakes and the driving wheels are of a new type, being internally expanding. The clutch is a metal to metal one running in oil, consisting of an alternate series of steel discs in frictional contact with each other. The whole thing is very compact, being arranged in the [illegible].

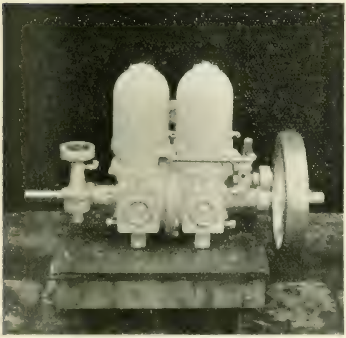


FIG. 2. 15-H.P. SPECIAL LIGHT F. AND B. MOTOR BY MITCHAM MOTOR COMPANY.

DAIMLER MOTORS.

The features which the Daimler Motor Company have had in view in designing their new models are simplicity of design, efficiency of transmission and accessibility of parts. Points which tend to bring about this condition of affairs are the engine-starting mechanism, the speed change control and the carburettor levers fitted upon the steering wheel. The efficiency of transmission has been further improved by the introduction of the latest type D. W. M. ball bearings and the accessibility of parts may be illustrated by the design of the engine base chamber, the gear and cross shaft cases, the commutator box, the hinged body and other features.

Other points to which attention may be directed are the suspension of the engine and gear upon the main frame in a manner which ensures perfect alignment; the inclined and mechanically-operated induction and exhaust valves actuated by a single cam-shaft. The single trembler coil system of ignition with one low-tension timing brush, and distribution on the high tension circuit, and the system of carburation.

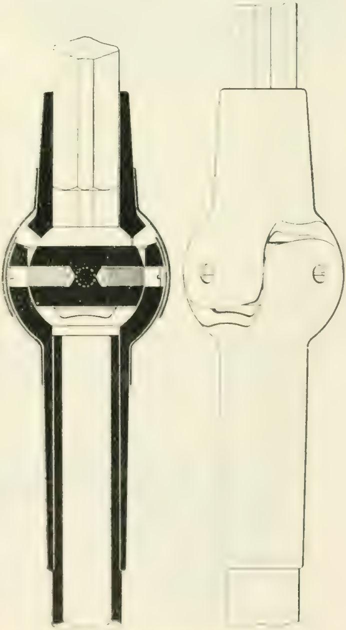


FIG. 3. MOYLE PATENT KNUCKLE JOINT.

which is said to give constant torque at all engine speeds. Fig. 4 shows cross shaft case (Daimler type), open.

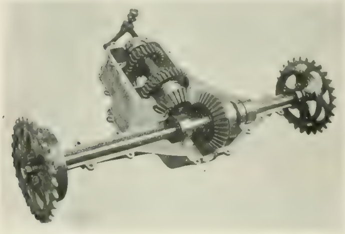


FIG. 4. DAIMLER CROSS SHAFT CASE SHOWING BALL BEARINGS.

THE NEWMAN VARIABLE SPEED GEAR.

The feature of this gear, which is applicable not only to motor-cars, but to many classes of automatic machine tools, is that from a shaft driven at a constant speed it is made to give a complete range of speeds varying from zero to the maximum without shock. The importance to the motor-car industry of a successful gear of this type has long been recognised.

Fig. 4 gives a general view of the mechanism. On the end of the constant speed shaft a crank or eccentric of variable throw is fixed. The throw of the eccentric can be varied at will. The four gear-rings all gear with one common pinion in the centre, this pinion being fixed on the end of the variable speed shaft.

It must be understood that the eccentric is not directly connected in any way to the pinion, the constant speed shaft being supposed to stand up out of the plane of the diagram, as shown in fig. 4, and there being a space between the eccentric and the pinion. When the eccentric revolves, the clutches are moved backwards and forwards at each revolution of the eccentric through an angle depending on the throw of the eccentric. The greater the throw of the eccentric the greater will be the angle, while if the throw is reduced to zero, the clutches will be at rest. As each clutch moves backwards and forwards it drives its gear-ring through a certain distance, and then releases, but it must be observed that before it has released, the next clutch has taken up the driving, and that therefore the motion of the pinion and variable speed shaft is continuous.

Different methods are used for varying and controlling the throw of the crank or eccentric, depending on the purpose for which the gearing is intended to be used. Fig. 6 shows the Newman Variable Speed Gear arranged as countershaft. The gear can also be fitted as lathe headstock.

"GAINE'S" REVERSIBLE PROPELLER.

This stand was an interesting feature of the marine section. Fig. 9 shows the propeller outfit with section lever. Except for small powers the blades are cast in phosphor bronze, and the reversing collars are cast in gun-metal and fitted with heavy ball races, which enable

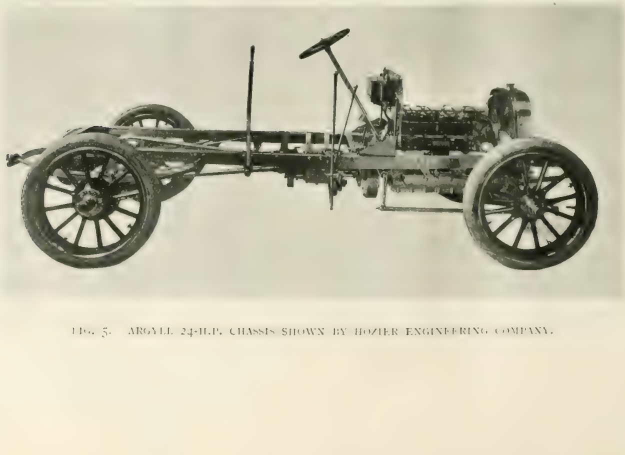


FIG. 5. ARGYLL 24-H.P. CHASSIS SHOWN BY HOZIER ENGINEERING COMPANY.

the pitch to be varied at will. The propeller boss is made in two halves transversely jointed, each half being cupped out on its interior adjacent to the joint to form a spherical bearing for the blades, the two halves of boss being kept in position by means of register ring. The locking ring boss is made with the internal mechanism identical with ordinary boss, but owing to being used for larger power the screws are secured by means of locking ring, the whole being turned down together to form solid torpedo shape.

The blades are cast in one piece of special hard gun-metal or phosphor bronze, with enlarged inner end of spherical shape on one side and a plain surface on the other. The neck of each blade rests in a bearing formed equally in the two halves of the boss. When the blades are in place a triangular space is left in the centre of the boss, which is completely filled up by the sliding block, the corners of which bear against the internal surface of the boss, the flat sides serving to support the three blades on their inner end and an efficient bearing is thus obtained for each blade.

The sliding block is made so that the blades have always full seating.

A very great feature in the propeller is that the blades can be kept at any desired pitch, and the pitch can be instantly increased or decreased without friction on the reversing collar.

A speciality is made of three-bladed reversible propellers which are specially designed and suitable for shallow-draught boats, and the use of these is recommended at all times in preference to two-bladed propellers for use with internal combustion engines, as naturally the three-bladed propeller tends greatly to steady the engines and reduces vibration. There is also a far more regular, efficient, and even drive with a three-bladed propeller than can be obtained with a two-bladed propeller.

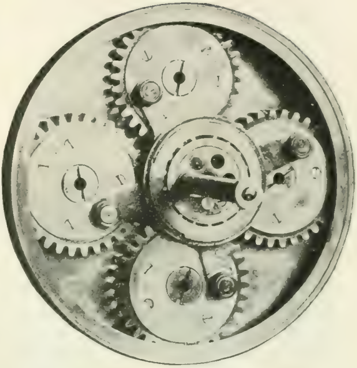


FIG. 5. NEWMAN VARIABLE GEAR. GENERAL VIEW.

A point to note is that all the mechanism is enclosed in the boss and there are no gears or levers to get out of order.

TWO MOTOR BOOKS.

The advent of the motor car has necessarily been accompanied by a wide demand for reliable information on car construction, and it must be said in favour of the publishers that there has been no lack of

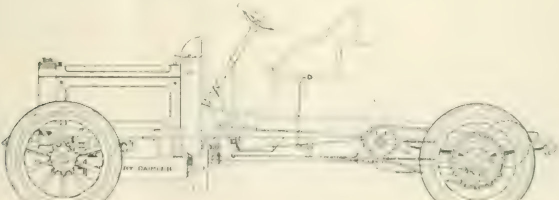


FIG. 6. DAIMLER MOTOR COMPANY'S CHASSIS.

endeavour to meet this requirement at a popular price. Two motor books, both excellent in their way, have lately reached us. Professor Spooner's "Motors and Motoring," published at 1s. by Messrs. T. C. and E. C. Jack, is much in the style of an introduction to the mechanics of motoring, and can scarcely fail to afford a good general grasp of the principles which underlie the construction and working of petrol cars. No attempt is made to describe any particular car, but a clear elucidation of principles is furnished, enabling the student to bring his knowledge to bear upon any given car.

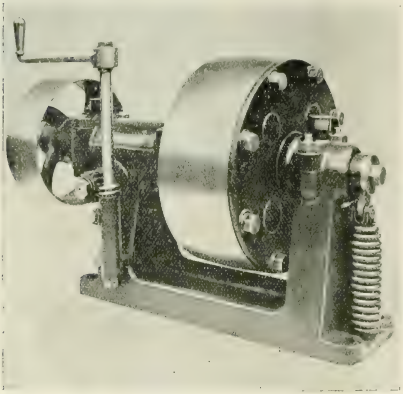


FIG. 7. NEWMAN VARIABLE GEAR, ARRANGED AS COUNTERSHAFT.

"Petrol Motors Simply Explained" is one of Messrs. Percival Marshall and Company's practical shilling manuals, the author being Mr. T. H. Hawley. The scope of the work will be fully understood from the author's object, which, by the way, has been very successfully carried out. This is to afford a simple explanation of the principles govering the action of the petrol motor, and the manner in which the power so generated is utilised to propel the vehicle, together with a few hints on control mechanism and driving; enough, in fact, to interest the elementary reader by starting him with a clear understanding of the general subject, so that the more elaborate text books and master works will be more easily assimilated by those wishing to probe the depths of motor-car design, and also be equally useful to the embryo driver or mechanic, by enabling him to assign the proper functions of each part of the engine and the general method of construction when inspecting a cycle or car. Both the above are fully illustrated.

SOAMES CHANGE SPEED GEAR.

This gear was first exhibited at the Crystal Palace recently, but an improved form was shown at Olympia. The points claimed for the gear are that the gear wheels are always in mesh, and that it is possible to change from one gear to the other without passing through intermediate gears. There is direct drive on the top speed. The gear was fully described and illustrated in PAGE'S WEEKLY of February 3rd last.

(To be continued.)

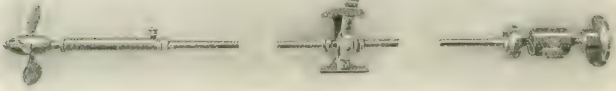


FIG. 8. "GAINES" REVERSIBLE PROPELLER.

CHEERFUL TRADE OUTLOOK.

PROSPECTS FOR 1905.

THERE is, happily, judging from the latest Board of Trade returns, some ground for the supposition that we are on the verge of a general improvement in trade. The year 1904 could not boast of anything like a satisfactory record. The downward movement in employment which commenced about the middle of 1900, continued during the year. Employment was good and better than in 1903, in tinplate manufacture; it showed little change in coal and iron mining, being moderate in the former and good in the latter; but in most other industries it was dull [illegible] showed a decline as compared with [illegible].

Expectations based on Past Records.

[illegible] are set out with an official crumb of comfort. Although 1904 was much below an "average year," there have been several years in which employment was worse. Taking the previous twenty-five years, such was the case in 1879, in [illegible] and in [illegible] and [illegible]. Then again it should be noted that following each of these periods of depression there has been an improvement, culminating in years of good employment (such as 1882, 1889–90, and 1899–1900 and succeeded by a decline to the next period of depresion.

Employment in January.

Are we on the rise of some such wave of prosperity? The employment statistics for the month of January would seem at any rate to offer considerable promise. Employment last month was better than in December. In the shipbuilding industry, about which we have lately heard so many pessimistic remarks, there was decided improvement, and more hands were wanted in the engineering, pig iron, and coal mining industries. The following is a summary of employment [illegible]

Coal Mining.

Employment during January was fairly good on the whole, and slightly better than a month and a year ago. At collieries employing 544,090 workpeople, the pits [illegible] days per week during the four weeks ended January 21st, 1905, as compared with 5·10 in the corresponding period of 1904. The time worked was, however, reduced on account of holidays to the extent of half a day per week in January, 1905, and [illegible] day in January, [illegible]

Iron Mining.

Employment continued good, and was better than a year ago. At the 124 mines and open works covered by the returns received from employers, the average number of days worked per week during the four weeks ended January 21st was 5·50, as compared with 5·87 in December, and 5.37 a year ago. The comparison with the December period is affected by Christmas and New Year holidays to the extent of 0·45 days per week in January, 1905, and by New Year holidays to the extent of 0·25 days in January, 1904.

Pig-Iron Industry.

Employment showed some improvement as compared with a month ago, and was considerably better than a year ago. Returns relating to the works of 108 ironmasters show that 306 furnaces, employing about 22,000 workpeople, were in blast at the end of January, or four more than at the end of December, and fourteen more than at the end of January, 1904.

Iron and Steel Manufacture.

Employment was much better than a year ago. Returns relating to 224 works, employing 84,214 workpeople, showed an increase in the total volume of employment during the week ended January 28th, 1905, of 6·3 per cent. as compared with the corresponding week of January, 1904.

Tinplate Trade.

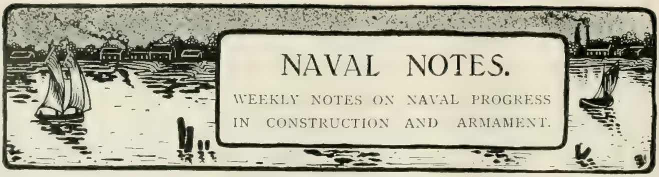
Employment in this industry was good, and was better than a month ago. It was much better than a year ago. At the end of January, 403 mills were working, as compared with 397 at the end of December, 1904, and 347 at the end of January, 1904.

Engineering Trades.

Employment in this industry, though still dull generally, was better than a month ago, especially in some of the shipbuilding centres. It is now only slightly worse than a year ago. The percentage of Trade Union members who were unemployed at the end of January, was 7·0, as compared with 8·4 at the end of December, [illegible] and [illegible] at the end of January

Shipbuilding Trades.

Employment in these industries was much better than a month ago, and is now better than a year ago. The percentage unemployed at the end of January, was 12·4, as compared with 16·4 at the end of December, [illegible] at the end of January, [illegible]



NAVAL NOTES.

WEEKLY NOTES ON NAVAL PROGRESS IN CONSTRUCTION AND ARMAMENT.

(BY OUR NAVAL CORRESPONDENT.

GREAT BRITAIN.

THE sad catastrophe at Queenstown, on board the submarine *A5*, on the 16th inst., whereby six men lost their lives, has, fortunately, been received by press and public alike without any hysterical outcry about the awful dangers of the submarine. Considering to what a degree the British seaman was ignorant of submarines only as far back as last spring, the number of serious accidents which have occurred have been very few. The explosion of gasoline at Portsmouth, when seven men were injured, the loss of *A1* at Spithead, when the whole of the crew were drowned, and the disaster last week, are the only cases where any serious results have followed from mishaps with these craft. The report of the inquiry which has been held at Queenstown will doubtless throw some light upon the cause of the explosion, which was stated at the inquest to have been the accidental ignition of a mixture of petrol vapour and air, by an electric spark.

With any amount of rumour prevalent as to wholesale reductions in the next Navy Estimates, it becomes a problem of some importance to discover in what way economies are to be effected. That some considerable saving would be effected by the abolition of the Gunnery School at Sheerness and the transference of the classes now held there, and on board the *Cambridge* at Devonport, to the naval barracks at that port, is indisputable, and it is currently believed that some such measure has been seriously under consideration at the Admiralty. It is not proposed to interfere in any way with the work carried on at the Whale Island, where Rear-Admiral Percy Scott has just relinquished command. Admiral Scott proceeds to Whitehall to inaugurate the new Department of Target Practice, and Captain F. T. Hamilton succeeds him in the *Excellent*. If any such change in the gunnery schools, as I have outlined above, comes into force, the efficiency of gunnery training would not be in any way affected, while the economics effected would go a long way to make up the total of the reduction we are told to expect.

FRANCE.

The loss of the cruiser *Sully* in Along Bay has considerably reduced the efficient strength of the French squadron in the Far East, the fighting force being now composed only of the two armoured cruisers *Montcalm* and *Admiral Gueydon*, with the "fast" protected cruiser *Guichen*, whose speed is rather less than that of our armoured *Drake* class. There are a number of small vessels on the station, but their fighting value is nil. It is announced that in consequence of the accident to the *Sully*, which struck on an uncharted rock, the French Minister of Marine has decided to send a surveying vessel to those waters to carry out hydrographic surveys on the coast.

GERMANY.

The new Navy Bill, which Admiral von Tirpitz has stated will be introduced next autumn, will contain provisions for the six armoured cruisers which were struck out of the Navy Bill of 1900, and seven divisions of torpedo-boats. He indicated that in the opinion of the German Admiralty, the great need of a navy was large battleships and fast cruisers. Submarines, he said, were interesting, but their value at the best was of a "local" character. From the character of the debate, which followed the announcement, it seems quite probable that the Navy Bill will be passed by the Reichstag without serious opposition.

ITALY.

The total of the Italian Navy Budget for 1905-06 is 127,246,962 francs (£5,089,878), of which 20,460,000 francs (£812,400) will be devoted to new construction. This sum does not include 600,000 francs (£24,000), which will be apportioned to the purchase and construction of submarines. The work to be carried on during the year includes the completion of the *Vittorio Emanuele* and *Regina Elena*, the advancement to the launching stage of the *Roma* and *Napoli*, the construction of one cruiser of 10,000 at *Castellamare*, and the commencement of a similar vessel at that port, the continuation of the submersibles *Glauco*, *Squalo*, *Narvalo*, *Otaria*, and *Tricheco*, and the further construction of twenty-seven torpedo-boats.

Thermometers and Pyrometers, with some of their Industrial Applications.

By Robert S. Whipple.

(Continued from page [illegible].)

THERMO-ELECTRIC THERMOMETERS.

I NOW come to what I may call the second group, the thermo-electric thermometers, in which is measured the electro-motive force developed by the difference in temperature of two similar thermo-electric junctions opposed to one another. Becquerel was, as far as is known, the first to use this method of measuring high temperatures (1830). He used a platinum-palladium couple. His son, Edmund Becquerel, was the first to realise the importance of using a high-resistance galvanometer with a thermo-couple. The electro-motive force is a function of the temperature, and as it is the current strength that is measured, it is important that the resistance of the whole circuit should be as nearly as possible constant; that is to say, the change in resistance of the couple itself should be small as compared with the change in the rest of the circuit. For some time the thermo-electric method was regarded with suspicion, Regnault having observed such irregularities in the couples in use that he condemned the method unreservedly.

All who are interested in high temperature thermometry owe a great debt of gratitude to M. Le Chatelier and Sir William Roberts-Austen. They taught us what metals to use for our couples, what formulae to employ, and what apparatus to use.

Chatelier showed that very few combinations of wires make satisfactory couples. Iron, nickel, palladium, and their alloys are absolutely unsuited for the measurement of high temperatures, since, when heated, these wires give rise to parasitical currents which may be relatively intense. He found that platinum and its alloys with iridium and rhodium are, fortunately, free from these faults. Of all the couples, those consisting of platinum, and an alloy of platinum with 10 per cent, of rhodium are the most durable for use at extremely high temperatures. On the other hand, a platinum, platinum 10 per cent. iridium, couple gives a larger electro-motive force, and therefore a more open scale.

Some recent work by Holborn and others* has shown that the change (decrease) in the E.M.F. of two Pt., Pt.-Ir. (10 per cent. Ir.) thermo-couples due to glowing at 1,100 deg. C. for eight hours amounted to 6 per cent. and 14 per cent., while the change (increase) in the E.M.F. of a Pt., Pt.-Rh. (10 per cent. Rh.) couple exposed to similar conditions was only 0·5 per cent. It has also been shown that the disintegration of the metals only occurs in the presence of oxygen.

Two methods are generally employed to measure the electro-motive force of a couple, the potentiometric, or the method of compen-

FIG. 4.

Diagram showing potentiometric method of measurement with thermo-couple.

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* Holborn and [illegible]

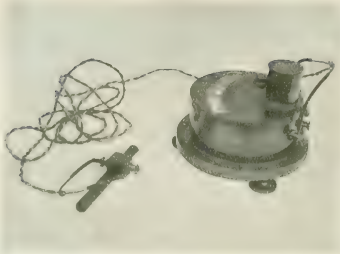

FIG. 5.
Thermo-couple with millivoltmeter reading directly in degrees Centigrade.

sation, and the galvanometric. The first method is rather cumbrous for general workshop use, but it is undoubtedly the more accurate of the two. Fig. 4 fully explains this method of measurement.

The galvanometric method is simplicity itself, the cold ends of the thermo-couple wires being connected directly to the galvanometer terminals. If the resistance of the circuit is constant, the deflections will be proportional to the electro-motive force. The majority of direct-reading instruments consist of a sensitive D'Arsonval galvanometer, the coil of which either carries a mirror reflecting a spot of light on to a scale or boom pointing to a scale. Fig. 5 illustrates the most recent form of platinum and platinum-rhodium couple made by the Cambridge Scientific Instrument Company, Ltd. The couple is connected directly to a millivoltmeter, the scale of which is divided in millivolts and degrees C.

A simple form of recorder is one in which the pointer of the galvanometer carrying at its end some device for puncturing the record sheet or a pen moves across the paper. The pointer is pressed down on the record sheet every minute, and makes a point corresponding to the deflection of the galvanometer (*i.e.*, the temperature at that instant).

The two methods of thermo-couple measurement may be compared as follows :—

The advantages of the galvanometric method are portability and simplicity; the disadvantages closeness of scale, and the fact that an error is introduced by the variation in resistance of the couple.

The potentiometer method has the advantages of an open scale, and that no error is introduced by the resistance of the couple. The only serious disadvantage is the fact that the apparatus must be worked in a laboratory, and requires a trained observer.

Professor H. L. Callendar has designed a recording potentiometer for use with thermo-couples which I will explain later.

Before leaving the thermo-couple I must mention the extremely ingenious method designed by Dr. Stansfield for obtaining sensitive records of recalescent points. A description of this was published in the fifth report of the Alloys Research Committee ; the illustration, fig. 6, is from this report.* Two junctions A, A are employed ; one is placed in the piece of steel, B, and the other in a piece of fine clay or copper, C. A sensitive galvanometer G, connected to both thermo-junctions, measures on a large scale the difference between the temperatures of B and C. Magnified records of the evolution of heat in B can thus be obtained, which are

FIG. 6.
Diagram of Stanfield's method of obtaining sensitive records of recalescent points.

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* Fifth Report of the Alloys Research Committee: Steel, by Sir William C. Roberts-Austen. Institution of Mechanical Engineers, Feb. 1899, p. [illegible]

not affected by the general fall of temperature of the system.

ELECTRIC-RESISTANCE THERMOMETERS.

The electric-resistance thermometer was first proposed by Sir William Siemens in the Bakerian Lecture of 1871, and it immediately came into general use in metallurgical work. Unfortunately, it was found that the pyrometer did not satisfy the fundamental criterion of always giving the same indication at the same temperature, and it was rather severely condemned by a committee of the British Association in 1874, who showed that these changes in resistance were due to chemical alteration in the platinum. These changes are very rapid if the platinum is quite unprotected, less rapid if the platinum is protected by a steel tube, and disappear if protected by a porcelain tube. All the volatile metals attack platinum readily, and silica and the silicates must be avoided. I recently experienced a striking case of the weakness of platinum in this respect. A thermometer was constructed, the outer covering of which was a nickel tube turned out of a casting, and presumably porous, The furnace gases passed through the nickel tube and rapidly destroyed the platinum. I am not quite sure what actually occurred, but chemical analysis showed the platinum leads to be largely impregnated with iron. It has been suggested that volatile nickel carbonyl was first formed, which combined with the iron tube of the upper part of the thermometer forming iron carbonyl, which, in its turn, combined with the platinum. Whatever occurred, the thermometer was rendered useless after comparatively little use. I mention this case in order to emphasise the care that should be taken to protect the platinum wires from noxious vapours when making accurate temperature measurements.

In 1886 Professor Callendar showed* that if the platinum is supported on a mica frame, in section that of a cross with equal arms, there is perfect insulation without any cause of alteration. He also showed that all joints in the wires should be made by fusion. Metallic solderings are volatile and attack platinum, and screw joints become loose. I cannot enter into a description of the classical work of Professor Callendar on this subject, but would refer anyone interested to a paper published by him in the Philosophical Magazine, February, 1899, entitled Notes on Platinum Thermometry, which gives an excellent summary of his work. The results of his researches—and they have since been confirmed by many workers—is to show that the platinum-resistance thermometer, if protected from strain and contamination, is practically free from zero changes over a range of 0 to 1,200 deg. C., and that it always gives the same indication at the same temperature. He also showed that different platinum wires agreed very closely in giving the same value of any temperature on the platinum scale, although they differed considerably in the values of their temperature co-efficients.

Professor Callendar pointed out that if R_0 denote the resistance of the spiral of a particular platinum thermometer at 0 deg. and R_1 its resistance at 100 deg., we may establish for the particular wire a temperature scale, which we may call the *scale of platinum temperatures*, such that, if R be the resistance at any temperature on the air scale, the temperature on the platinum scale will be $\frac{R - R_0}{R_1 - R_0} \times 100$. For this quantity he employs the symbol *pt.*, its value depending on the sample of platinum chosen. In order to reduce temperatures on the platinum scale to the gas scale, it is necessary to know the law connecting "T." and "*pt.*" They are, of course, identical at 0 deg. and 100 deg., and experiment has shown that the formula

$$T - pt = \delta\left[\left(\frac{T}{100}\right)^2 - \frac{T}{100}\right]$$

expresses the curve of the relationship between them in other parts of the scale. The value

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* On the Measurement of Temperature. H. L. Callendar. Phil. Trans. Roy. Soc. A, 1887.

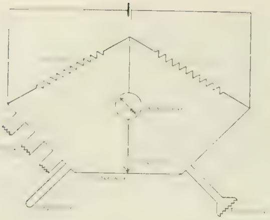


FIG. 7.
Diagram showing method of measuring temperature with resistance thermometer.

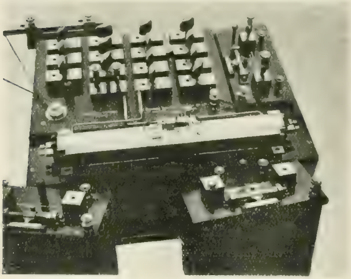


FIG. 8.
Callendar and Griffiths' Bridge for extremely accurate temperature measurements.

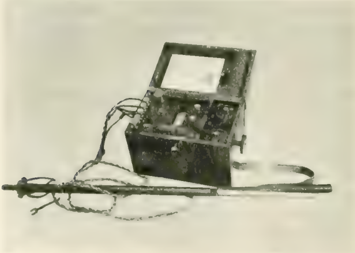


FIG. 9.
Whipple Temperature Indicator with Callendar and Griffiths' Resistance Thermometer.

of δ depends on the purity of the platinum wire used; it can be obtained from observations at three known temperatures. A table of corrections is used to convert temperatures on the platinum scale to those on the gas scale, or the instruments used with the thermometers read directly on the gas scale.

The platinum resistance-thermometer consists of a fine platinum wire wound on a mica frame connected by means of stout copper or platinum leads to terminals in the head of the thermometer. Two similar leads, but unconnected to the coil, pass through the whole length of the thermometer, and act as compensating leads. By this means no error is introduced by the variation of the temperature of the wires connecting the thermometer with the indicator or recorder. The diagram, fig. 7, explains the general arrangement for the use of Callendar and Griffiths' resistance thermometer. The thermometer coil forms one arm of the bridge, whilst the compensating leads and the balancing coils form the opposite arm, a pair of equal ratio arms being generally used.

If temperature measurements are to be made with a resistance thermometer to a high degree of accuracy, a specially designed Wheatstone bridge and a sensitive galvanometer must be employed. Several of the leading features of the well-known Callendar and Griffiths' bridges can be gathered from fig. 8, which is an illustration of a bridge recently made for extremely accurate temperature measurements. For general commercial use, the author has designed a bridge (fig. 9) which is a modification of one invented by Professor Callendar and Principal Griffiths, in which the temperature values are read directly in degrees C., and rapidly varying temperatures may be followed. The instrument is especially useful for measuring the temperatures of boiler flues.

(*To be continued.*)

Phil. Trans., Vol. [illegible] pp. 343 [illegible].

A paper read before the Cleveland Institution of Engineers, Middlesbrough.

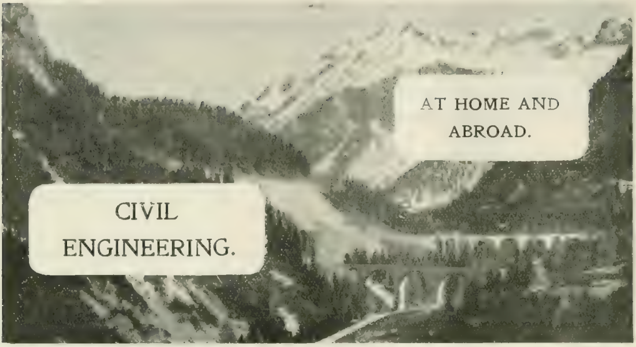
OUR WEEKLY BIOGRAPHY.

MR. J. M. WHILE, M.Inst.C.E.

MR. J. M. WHILE, M.Inst.C.E., Member of the Council of the Iron and Steel Institute, received his professional training at the works of Messrs. Fothergill and Hankey, and with Messrs. John Brown and Co. In 1872 he accepted an appointment at the Gorton works of Messrs. Bolckow, Vaughan and Co., where he was responsible for the contract for the whole of the manufacture of steel rails. His next position was that of manager of Messrs. Bayley and Dixon's mills; he remained with this firm for a period of five years, and then went to the Dowlais Iron Company. He occupied the post of general manager of the Darlington Steel and Iron Works for ten years, and for the last fourteen years has been general manager of the Barrow Hematite Steel Company. When at Messrs. Brown, Bayley and Dixon's he patented the system in general use to-day for the rolling of tram-rails; that is, the use of a vertical roll placed on the same axis immediately between the journals of the horizontal rolls. He invented and adopted skids for the purpose of conveying rails along the hot bank, which have now become general. Mr. While has also invented and adopted several other mechanical improvements, which are at the present time in operation at the Barrow Company's works.

MR. J. M. WHILE, M.INST.C.E.

In addition to the many improvements he has effected, he has rebuilt, on the most modern lines, a very excellent Bessemer shop, which, with the heated pits and conveyance to the rolls, saves the firm about £40,000 per annum. The Siemens' furnaces have been enlarged from twenty to fifty tons each. A complete electric installation has been put in, consisting of one 100, two 250 and one 500 kilowatt dynamos. The last extension of note is one which has been carried out in record time, viz., the full equipment of eight Babcock and Wilcox boilers, engine-house, a set of blowing engines, pumps and condensers, all of which, including the building of the engine and engine-house, has been completed in nine months.



At its meeting on Tuesday, the Institution of Civil Engineers discussed the papers on "Alfreton Second Tunnel," by Mr. Ernest Frederic Crosbie Trench, M.A., B.A.I., M.Inst.C.E., and "The Reconstruction, of Moncreiffe Tunnel," by Mr. Dugald McLellan, M.Inst.C.E., the succeeding paper being "Surface Condensing Plants and the Value of the Vacuum Produced,' by Mr. Richard William Allen, Assoc.-M.Inst.C.E. A students' meeting will be held this evening, at 8 p.m., when the papers to be read are: 'Morecambe Sewerage: Method of Laying a 15-in. Cast-iron Sewer under the London and North-Western Railway," by Mr. F. D. Flint, Stud.Inst.C.E., and "The Reconstruction of Bow Bridge over the River Lea," by Mr. H. M. Rootham, Stud.Inst.C.E. Mr. G. M. Lawford, M.Inst.C.E., will occupy the chair. Details of Bow Bridge appeared in a recent issue of PAGE'S WEEKLY.

At a meeting of the Metropolitan Water Board, the Works and Stores Committee presented a report in which they stated that the chief engineer had submitted to them a scheme which provided for an interchange of water between the Southwark and Vauxhall and Lambeth districts, whereby a better pressure could be given to the higher areas of those districts with a very great economy of pumping and other expenses. The scheme had the advantage, moreover, of being a part of a larger scheme by which the two districts in question could be worked together with greater benefit to the public. An estimate of £30,630 for the necessary works was approved.

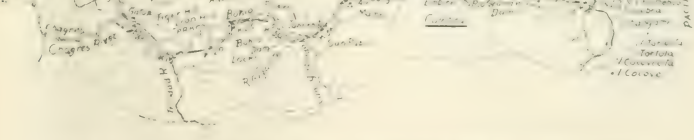
A Times correspondent writes: Instructions have been issued for work to commence forthwith upon the great irrigation scheme for the Punjab which has been sanctioned by the Secretary of State for India. The total cost will be 782 lakhs of rupees (£7,213,333), and it is hoped to complete the undertaking in about nine years. The Upper Jehlam and Upper Chenab canals are to be taken in hand first, as the work on the third project, the Lower Bari Doab Canal, is easier, and the canal will be dependent for its water supply on the other two. The total area to be irrigated by these works will be some two million acres, the people of which will thus be protected from famine, and a large part of which, now sterile, will be opened up to irrigation. The scheme for converting Wular Lake, in Cashmir, into a reservoir to feed these canals does not form part of the project actually sanctioned, but it can be taken in hand at any time hereafter as an addition, the estimated cost being only 49 lakhs of rupees. Its principal use will be to increase the supply of water available for irrigating the cold weather crops, which are especially important in the Punjab.

Mr. John Barrett, the United States Minister at Panama, discusses the Isthmian canal and its problems in the current number of the American Review of Reviews. In justice to Mr. Wallace, the chief engineer, and in order to correct some of the newspapers, which have unfairly assailed him for advocating a sea-level canal, and have quoted him as saying that such a waterway would cost $300,000,000 and occupy twenty years in construction, Mr. Barrett calls attention to the fact that the chief engineer has not yet advocated either a sea-level or a high-level canal, and has not yet submitted any final figures as to the cost or time of construction. These stories and criticisms emanate from the statement he made before the Congressional Committee when they questioned him during their recent visit to the Isthmus. If this official report, later on submitted to Congress, is carefully read, it will be noticed that he himself did not make any final estimate or express any decided views. He simply informed the Committee what were the estimates and the conclusions for a sea-level canal that could be based on the figures of the former Commission, respectively of $300,000,000 and twenty years.

The Minister makes a brief reference to the much-discussed dams and artificial lakes which cut considerable figure in the plans of the Canal Commission. These are generally described as the Gatun, Bohio, Gamboa, and Alhajuela projects. The facts developed by the technical investigations of the engineers have practically eliminated all of these except the Gamboa dam. This will so restrain the waters of the famous Chagres River at all times, especially at the flood, that they will not flow into the canal so as to impede navigation or fill it with sediment. It is, in other words, practically the solution of the Chagres problem. The greatest engineering difficulty heretofore emphasised in constructing a canal acress the Isthmus has been the presence cf the Chagres River cutting into and across [illegible]

The dam at Bohio would require a gigantic structure, the highest in the world above bed-rock and the deepest [illegible] a large lake reaching back to the Culebra section and entered by a series cf great lecks, thereby saving a long distance of excavation. In other terms, the channel of the canal would extend fifteen miles through an artificial inland lake which would at the same time impound the waters cf the Chagres River and allow them to pass off through a spillway without damage to the rest of the canal. The Bohio is only a necessity for the 90-foot level in combination with the artificial lake, while the Gamboa dam would serve all levels below the 90-foot. The Bohio dam could only be constructed at an enormous cost and in the face of serious engineering difficulties, while if injured by earthquakes or by explosives in time of war it would render the canal useless.

The Gamboa dam, which impounds the waters of the Chagres to the east of the canal and in the mountains, also carries with it the important project of a tunnel through the lateral mountains which will keep the surface of the water in an artificial lake at such a distance below the crest of the dam as to provide sufficient capacity to take care of the maximum flow of the Chagres without causing the dam to overflow. The water drawn off by the conduits through the dam will generate electric power and also serve to reduce the level of the water above the dam. In case of a high-level canal, it can also provide the necessary water for the operation of the summit level. In the opinion of the best experts, the Gamboa scheme is entirely feasible, and will probably be followed, unless it is entirely given up, and a dam at Bohio constructed. The Alhajuela project is supplementary to the Bohio plan, and would simply form an additional reservoir farther up the Chagres to impound a portion of its waters.



MAP OF THE PANAMA CANAL ZONE, SHOWING THE LOCATION OF DAMS AND ARTIFICIAL LAKES.

ENGINEER'S BOOK OF THE WEEK.

"OIL FUEL."

THE weight of expert opinion appears to incline more and more to the view that liquid fuel will, in future, be utilised in an increasing degree. The technical and mechanical difficulties which have stood in the way are by no means yet entirely overcome; indeed, as the report of the United States Fuel Board and the experiments conducted by our own naval authorities have made clear, the nature of certain problems yet to be solved has only now been really defined. The advocates of the use of liquid fuel have also to face the initial difficulty of supply. The Pennsylvanian fields are fast becoming exhausted, and unless another prolific source of supply is discovered in the near future, the application of liquid fuel will be considerably hampered, if not very seriously checked. The author of this book is not, however, disposed to be pessimistic in this respect.

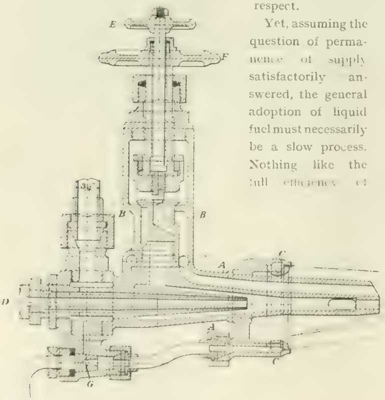


FIG. 1. HOLDEN'S OIL-FUEL BURNER FOR LOCOMOTIVES.

Yet, assuming the question of permanence of supply satisfactorily answered, the general adoption of liquid fuel must necessarily be a slow process. Nothing like the full efficiency of coal has yet been obtained, and it is obvious that in this respect the case of liquid fuel is in its infancy. It need not be impressed upon the engineer that liquid fuel is an infinitely more delicate thing to handle than coal and that, consequently, the burners are by no means as efficient as they can be made. Even so, however, as Mr. North points out, the use of liquid fuel yields distinct economic advantages over coal, and in its application still more significant economies come to light.

One of the pioneers in the use of petroleum for steam raising was Mr. James Holden, the locomotive superintendent of the Great Eastern Railway, and the latest form of Holden burner is shown in fig. 1. The author gives a detailed description of the burner, but it is doubtless familiar enough to readers of PAGE'S WEEKLY, and it is enough to point out that *AA* is the coned body, *BB* the specially designed regulating valve, *CC* the hollow ring behind the nozzle which enables the Holden burner to dispense with the brick walls necessary with other devices, *D* the steam jet, *E* the valve wheel, *F* the wheel by the agency of which the main supply of fuel is first admitted, and *G* the cock which regulates the steam supply to the ring on the injector. Readers may be reminded of the special construction of the valve by the use of which very fine adjustment in the flow of the oil fuel is possible. The author also refers to the Kermode, the Körting, the Orde, the Swensson, the Durr, the Rusden and Eeles, and the Armstrong-Whitworth burners, all of which are illustrated in the book. It is admitted, however, that the perfect oil burner has yet to be devised, although the direct pulverisation of the oil is coming to be recognised as the proper method.

The most interesting chapters of the book are, perhaps, those on the use of oil fuel for marine purposes, naval and mercantile. In this connection, as indeed with coal fuel, if satisfactory results are to be obtained, a great deal depends on the arrangement of the furnace, and on this field the battle of the burners has again been fought. In order to save the coal which it is necessary to use to provide the steam for pulverising the oil, experiments have been made with the use of hot air under the Meyer system. Fuel is the life blood of a

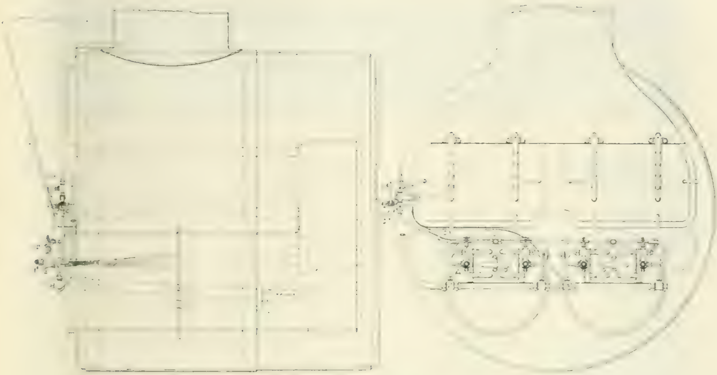


FIG. 2. ARRANGEMENT OF HOLDEN'S BURNER FITTED TO MARINE BOILER.

war vessel, and what has hampered the use of oil fuel by the British navy is, no doubt, the fact that while there is an ample coal supply in these islands, oil fuel is geographically out of reach. Latterly, however, naval authorities are seriously grappling with the oil fuel problem, with results which are likely, it is thought, to lead to important developments. It is thought that liquid fuel ought to be successfully used on torpedo [illegible]. The evaporative duty required from the boilers of destroyers is greater than that required from the boilers of any other type, and, as the author reminds his readers, while it is possible to burn enough liquid fuel to produce the required duty in boilers hitherto using coal at natural draught, or even coal at moderate forced draught, difficulty has been found in burning enough oil-fuel with burners of the destroyer type to produce the same duty as that realised under coal at great air pressure. The question of economy in fuel in destroyers when at full power is of comparatively little importance; but the production of the maximum power is essential, and the further experiments now in progress will probably solve the difficulty. The experiments conducted by the Liquid Fuel Board has shown that it is now possible to force the combustion of oil, and that the greatest evaporation per square foot of heating surface secured with coal can be greatly exceeded by an oil installation of modern design. The problem of successfully installing an oil fuel appliance on board a warship, as Mr. North points out, grows more complicated as it is further investigated. The arrangement of Holden's burner fitted to a marine boiler is shown in fig. 2.

The appendix contains a series of tables showing the results of tests made by the United States Liquid Fuel Board in a Hohenstein water-tube marine boiler under forced and natural draught, and using air burners and steam burners.

A word may be said in conclusion as to the use of oil fuel for metallurgical and other purposes. It should, the author believes, form an unequalled medium for smelting operations; the chief objection being that of cost. Various forms of smelting furnaces designed for the use of oil fuel are described, but, as the author points out, although the smelting of iron ore by the use of oil fuel has often been suggested, the attempts made have so far been neither mechanically nor commercially successful. In the blast furnace, if coke or charcoal should be entirely replaced by oil, the charge would, in all probablity, become too dense to allow the combustion gases to escape freely.*

* [illegible] H North. With [illegible]

Automatic Signalling Arrangements on the District Railway.

IN anticipation of the more strenuous conditions caused by the shorter headways planned, the District Railway Company has had installed a system of signalling for which great improvements over all earlier systems are claimed. This plant presents features of more than ordinary interest, and is, moreover, the first installation of its kind in this country.

The section of line between Hanger Lane Junction and South Harrow, has now been worked electrically by the District Railway for over a year, with results that augur well for its success on the more important sections of the line. The length of this trial section is about five miles of double track, and it is divided into block sections, varying in length from 1,400 ft. to about 3,500 ft. On the District Railway generally there are both positive and negative insulated traction rails; the running rails not being used for the traction current. The space between stations is usually divided into two blocks, that is, a "starting" and a "berth" block, and the signalling is on the "normal clear principle.

The signals themselves are of the ordinary mechanical type, and in no way specially adapted for power or automatic working; consequently, they are being replaced by special arms with Westinghouse electriopneumatic signal motors, fitted close under them, and the ordinary counterweight abolished for one directly on the signal arm as shown in the illustration (fig. 1). The motors are enclosed in cast-iron casings, and, being essentially strong and simple, are not affected by climatic conditions. They are controlled by small pin valves, worked by means of electro-magnets in the local signal circuit. Signal cabins are required only at each end of the branch, or where there is a cross-over road; in the latter case they are normally closed, being opened only when required.

An automatic stop prevents trains from over-running home signals (fig. 2). This consists of an iron arm between the track rails actuated by a compressed air motor acting in unison with the adjoining signal motor. When the signal goes to "danger" this arm is elevated to a position in which it engages with a cock on the air brake system of the train; thus the brakes are instantly and automatically applied if, for any reason, the driver should run past the signal.

No great saving in first cost need be expected from an automatic installation, as the initial expenditure would probably be quiet as great as that incurred in laying down the mechanical system. The working expenses, on the other hand, should be very much reduced, the saving in labour being a most important item, and the cost of renewals and repairs trifling. But, undoubtedly, the greatest advantage of an automatic system is its suitability to the requirements of a very frequent and quick service. The blocks may with facility be made as short as is compatible with the running speed and brake power of the trains. The strain on the signalmen, inseparable from such a service, is abolished, and the safety of passengers is thus independent of the personal equation.

The principles of the system may be best understood by reference to the diagram (fig. 3). One of the track rails is electrically continuous through the

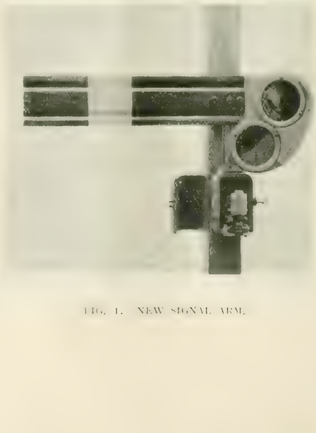


FIG. 1. NEW SIGNAL ARM.

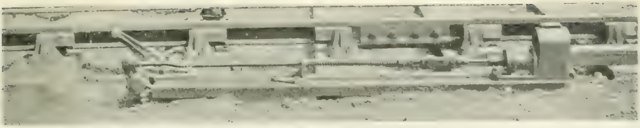


FIG. 2. AUTOMATIC SIGNAL PREVENTING TRAINS FROM OVER-RUNNING HOME SIGNALS.

whole length of the plant and constitutes the positive conductor from the generator to the individual track sections. The other rail is cut up into block sections by means of special rail joints insulated with fibre. All uninsulated rail joints are bonded to ensure electrical continuity. Power for the operation of the system is generated at 65 volts pressure by motor generators placed centrally, the negative terminals of which are connected to an insulated negative main running the entire length of the system. This main is connected to each section of the sectionalised track rail at a point near the latter end of the block, *i.e.*, the end at which the train leaves, as distinct from the end at which it enters. It will be seen, then, that there is a potential difference of approximately 65 volts, between the continuous—positive—rail and the insulated negative main.

Resistances are interposed in the connections between the negative main and the sectioned rail, which reduce the potential difference between the rails to, in the present instance, from 3 to 6 volts, according to the length of the block and various local conditions.

Let us now consider the circuit for a single block unoccupied by a train. The current from the positive brush of the dynamo flows along the continuous rail, and thence through the two relays, one at each end of the block, and through the ballast between the rails, all in parallel, to the sectioned rail. From this it flows through a relatively large resistance to the negative main and back to the machine.

Now, suppose a train enters the block. Obviously the current now flows through the practically negligible resistance of the car wheels and axles from one rail to the other, and the relays are shunted, with the result that the signal is allowed to go to danger.

The "track battery" resistances connected between the negative main and the sections of the sectionalised rail prevent the generator being short-circuited when the track circuit is shunted by the axles of the train. In fact, these resistances bear such a relation to the combined resistance of the road bed from rail to rail and the two relays, all in parallel, that the shunting of the track cuts out only a small percentage of the total resistance of the circuit. Thus the current increase in a circuit, when shunted, is not great; this is important, as it is advisable to keep the track potential as nearly as possible constant. An increase of the total current, resulting from the blocks being occupied by trains, affects the potential between the rails of unoccupied sections, increasing the transmission loss in the negative main.

The loss in the continuous track rail may generally be neglected on account of its large section. Another circumstance directly affecting this track potential is the variation of the resistance of road bed according to weather conditions. Broken stone forms much the best ballast from an electrical point of view, and cinders the worst. It may here be mentioned, however, that though on several occasions recently the track rails on this system have been flooded, the operation of the signals has, we are informed, been in no wise interrupted.

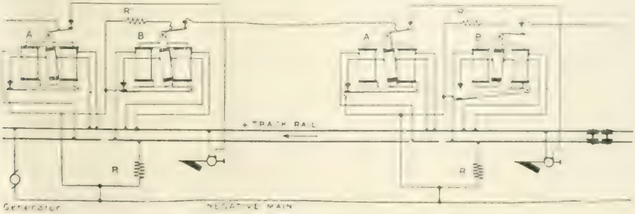


FIG. 3. DIAGRAM SHOWING CONNECTIONS.

Next we come to the consideration of the circuits of the track relays, which control the signal circuits. Fig. 3 is a diagram of the relay and signal magnet circuits for a single block. The track coils (see fig. 3) of the relays are permanently connected across the rails at that end of the block at which the relay is placed. Between the pole pieces a polarised armature is suspended from a pivot. This armature bears a winding of considerable resistance, and is connected between the positive rail and the negative main through a contact—operated by the track coil armature—which is closed when the track coils are energised. To the polarised armature is rigidly connected an arm which actuates a contact, the function of which is to open or close the local circuits controlling the signal motors The operation of the relays is then as follows: When a difference of potential exists in the normal direction between the rails, *i.e.*, when there is no train on the block, the relay track coils are excited and draw up the armature, which closes the circuit through the polarised armature. The polarised armature is then attracted to one of the poles of the relay, and, swinging over, closes the contact in the local signal circuit.

As already mentioned, there are two relays in each block, one at each end: these are duplicates, and operate normally in a precisely similar manner, each working a contact in the local signal circuit. These contacts are in series, as shown clearly in fig. 3—relays *a* and *b*—and, unless they are both closed, no current can flow through the signal magnet, and the signal will therefore remain at "danger" by gravity.

The position of the apparatus when the block is empty has been indicated above: both relays energised, the local signal circuit closed, and the electromagnetic valve operating the pneumatic signal motor consequently open, admitting compressed air to the motor, which holds the signal arm "off." As soon as a train enters the block, the relays are short-circuited by the car axles, and thereby de-energised, permitting their armatures to drop, and thus breaking the circuit through the polarised armature coils. The polarised armatures then swing back from their position in contact with one of the track-coil pole-pieces, and in doing so break the signal circuit at two points in series. The electro-magnet operating the admission and exhaust valves of the pneumatic signal motor is de-energised, and the exhaust is opened, permitting the signal to return to "danger" by gravity. It is, of course, a canon of successful automatic signalling that any interfering influence must, if it has any effect at all, cause the signal arms to go to "danger," and not bring them "off."

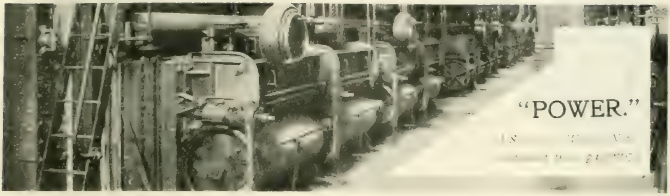
So far, so good; but experience has shown that the greatest obstacle to the success of automatic signalling, on electric railways in particular, is the liability of the relays being operated by extraneous currents so as to cause a false "clear" indication when danger should be shown. The particular claim of the system under consideration is that it is impossible for an extraneous current, from whatever source, to bring the signal arm to the "off" position when it should stand at "danger."

The main source of extraneous currents affecting the signals is the 500-volt traction power circuit, and when, as is the case at Ealing, the track is not used as a return, the presence on the block sections of current from this source is abnormal. Faulty insulation of the train equipment, positive and negative rails, positive cables, etc., is the most frequent cause of leakage to the track rails. Whether currents other than the signalling current on the track rails are normal, as would be the case were one of the track rails used as a power return, or abnormal, as in the present case, is immaterial, such currents would be equally disastrous to a susceptible system, and are, it is said, impotent to affect the system considered. Faults in the main power circuit occur with sufficient frequency to demand the closest attention on account of the disorganisation of the traffic which they may cause, but even if they were rare, the least liability to give false signal indications of safety would forfeit all claims for consideration.

Although in the present system, it is possible for the extraneous currents to energise either one or both relays while the train is in the block, these latter are so interconnected that is is not possible for them both to be energised in the normal direction at the same time by extraneous currents.

A few words may be added with regard to reliability. The only parts of the mechanism which can be described as in any way delicate are the relays, and these are enclosed in weatherproof boxes, where they can readily be examined at intervals. The air pressure used is about 70 lb. per square inch, which enables compact motors to be used for signals, points, stops, etc. The air motors employed, work, we are told, year in year out without giving the least trouble. The piping is compact, the electrical wires few and small, and the alterations to the track of a trifling nature. The system is applicable where track return is used with either third rail or overhead trolley wire.

The signal motors, relays, and other special apparatus were manufactured at the London works of the Westinghouse Brake Company, and supplied direct to the Underground Electric Railways Company of London, Ltd., who installed the apparatus themselves.



"POWER."

[illegible]

THE boilers of locomotive engines, although subject to various restrictions, in the way of dimensions and weight, are, nevertheless, beyond all comparison most energetic steam producers. The principal reason for this is, of course, the intensity of the steam blast in the chimney, which enables them to burn usefully an enormous amount of coal per unit of grate surface, although there are two other causes—already touched upon—which in lesser degree contribute to the efficiency of this type of boiler. First, the relatively clean heating surfaces, as compared with boilers having a more sluggish rate of combustion: there is little soot deposited in the firebox plates, or tube surfaces, of an express locomotive travelling at full speed; and, secondly, the shaking to which these boilers are subject while in active use, which has the effect of promoting the escape and discharge of the globules of steam as they form on the heated surfaces.

It must not be forgotten that the fierce combustion in the locomotive firebox is not maintained for any great length of time; and is, as a rule, alternated with more or less lengthened periods of inaction, during which the grate-bars and air spaces may be thoroughly cleansed, and the fire skilfully rebuilt in preparation for the next spell of high-pressure activity. And here we come to the real distinction betwen the locomotive, and the loco-type boilers. The latter, differing little in outward appearance, is commonly in use for ten or twelve hours at a stretch upon six days of the week; and with less skilled attendance, and inferior fuel, demands a very different scale of proportions from its fire-eating brother of the railway locomotive.

In proportioning a locomotive boiler so as to give the best efficiency, regard must be had to the conditions under which the boiler is to work. If we want a boiler which is to develop the maximum of power in a limited space, if we are prepared to put a highly-skilled fireman in charge, and to allow the requisite intervals for cleaning the fire, and washing out the boiler, we turn unhesitatingly to railway practice, and put in a boiler whose tube surface is nearly or quite sixty times the grate area, knowing that the tremendous energy of the blast demands a corresponding increase in the amount of tube-surface required to absorb the heat on its way to the chimney.

If, on the contrary, we are designing a boiler for stationary purposes, we fall under a different set of conditions at once. In order to compare the different classes and sizes of boilers, it is desirable to fix upon a unit to which all the dimensions of any boiler may be referred; and this unit may conveniently be taken as one square foot of grate area. From this, as a basis, we may proceed to determine the extent of surface in firebox and tubes, which will best fulfil the requirements of the service for which the boiler is intended.

If we examine the proportions of ordinary stationary, or loco-type, boilers by several leading makers of this class, we shall find that taking all-round sizes, the average of a large number of examples will give the ratio $\frac{\text{Firebox heating surface}}{\text{Grate-area}}$ as very closely in the neighbourhood of 5, and the ratio $\frac{\text{Tube heating surface}}{\text{Grate-area}}$ averages about 23¼. Whereas, in the case of thirty locomotives boilers taken from the leading British railways the ratio of firebox heating surface to grate-area averages 5·86, which does not differ widely in itself from the first-named range of boilers, but is accompanied by an average ratio of tube-heating surface to grate-area, of more than double that found necessary for the stationary loco-type, viz., 58·35, and similar ratios taken from the locomotives of nine American railroads show 5·66, and 59·61 respectively.

SCIENCE IN THE IRON FOUNDRY.

By J. E. Stead, F.R.S., F.I.C.

BY the term Science, as applied to the iron foundry, is meant the exact knowledge of things relating thereto, which has been proved by demonstration. During the last thirty or forty years metallurgists have been steadily advancing in knowledge as to what is right and wrong in the fundamental principles, particularly in connection with the metallurgy of steel. It is unfortunately a fact, however, that, until within recent times, the iron foundry has not received the attention which it deserves; there is, however, a good deal of information regarding the correlation of chemical analysis and mechanical properties of cast iron to be found in many publications both in Europe and in America.

Although science in the foundry may be said to embrace all the facts relating to foundry practice, it is not my intention to dwell upon more than the effect of metals and metalloids on cast iron, leaving the consideration of the effect of varying casting temperatures and other matters for future communications.

THE MIXING OF METALS.

The analyses of different classes of metal castings show that there is great variation in composition, but that generally speaking there is a suitable analysis for every class of casting. By this is meant that chemical analyses of several of the same class of first rate castings, which have been proved by long and useful service to be excellent, do not vary to any great extent. This being so, it should always be the aim of iron founders to work synthetically or to build up by proper mixture of metals, what practical experience and chemical analyses have shown to give the best results.

There is much to be said in favour of the old-fashioned method of mixing metals employed in the more carefully conducted works, in which a large number of brands and qualities of iron are kept in stock, and are mixed in the proportion which long and painstaking observation of the foreman foundryman has proved in practice to give the very best results in each class of castings. Indeed, it is the castings made by this method to which analysts were obliged to go in order to ascertain what was the best chemical composition, and thus to obtain their standards.

It was this method of mixing which prevailed in the early days of steel making by the Bessemer process, and provided the foreman had the requisite knowledge, and was allowed to have the almost infinite variety of pig irons he demanded, he obtained good and constant results.

It was believed at that time that every brand of Bessemer iron had some peculiar property distinct from that of other brands, and that good steel could only result from their proper blending. I have met steel blowers thirty-four years ago, who maintained that it was impossible to make good steel from one brand only. They had no knowledge of the effect of silicon and sulphur, and they had, without doubt, found by bitter experience that no reliance could be placed upon the iron sent from one maker only. The metal at one time would blow far too hot, at another time so cold as to "set" in the ladle, and even when it behaved properly in the converter, it would sometimes break up at the hammer, and when finished be excessively cold-short, variations which would naturally be expected, even at the present day, if there were no analytical control. Considering that these old-fashioned Bessemer steel makers should have elaborated the only possible system by which regularity could be obtained, it is without doubt, greatly to their credit, for where there were no accurate analyses of the iron available it was absolutely necessary to use a mixture of many different brands of iron to obtain anything like regularity. With our present knowledge, we know that all the brands would vary at that time just as they do to-day in different deliveries, that some would contain more and others less than the normal quantities of the essential elements, and that by mixing the irons together the variations were averaged.

A PERSONAL REMINISCENCE.

In my own experience, when at the Gorton Steel Works of Messrs. Bolckow Vaughan and Co., Ltd., the blower" insisted on having the usual mixture of irons from the West Coast to work with the iron supplied from the Witton Park Works near Bishop Auckland, which it was imperative he should use alone without any admixture and it took much time to convince him that it was not necessary to have different brands, provided the composition of the East Coast Iron approximated to that of the mixture he regarded as suitable for blowing. Knowing the real significance of this preference I eventually persuaded him to try mixing small quantities from six or seven separate stacks of the same brand of Witton Park hematite, instead of taking each charge from one stack only. This he did, but unfortunately for the chemist the average mixture, so made, blew very hot in the converter. It often happened that much silicon was left in the steel, and the rails produced from it were brittle in consequence. The blower explained that this was due to the iron being freshly made, and that if it were kept in stock for six months so as to get a good coating of rust upon it, " the *sulphur* would be removed, and the iron would then blow all right and make good steel." Knowing as I did that the extra heating in blowing was due to silicon. I suggested putting cold scrap steel into the cupola and melting it with the metal (for the simple reason that it was impossible to stop the works for six months to allow time for weathering the metal). His answer was somewhat startling for he informed me " that every piece of steel put into the cupola vanished up the cupola stack and none of it ever got into the converter." He was, however, persuaded to charge cold scrap into the converter, and in this way we obtained steel free or nearly free, from silicon. So convinced was he, however, that rusty iron was an advantage, that it became his practice to project water from a hose pipe upon the stacks of iron so as to accelerate rusting. This behaviour on his part, based on a long previous experience in Bessemer's own works, led me to investigate whether, or not, weathering was an advantage in removing sulphur. I made a special experiment to test it, but found that the proportion of the elements in the weathered iron were the same as in the original pig, and that no sulphur was removed. There was, however, less sand on the outside of the weathered pigs, and a considerable coating of rust. It occurred to me that the rust or oxide of iron might be responsible for removing some of the silicon in the iron when it was being melted in the cupola, and on actual trials being made with old and new pigs, with identical quantities of silicon in each case, it was found that the rusted iron gave melted metal with a little less silicon than was present in the new-made iron. It appeared from this, then, that the blower had some grounds for wishing the iron to be weathered. It was not sulphur, however, but silicon which was removed as the indirect result of weathering.

By making iron with less silicon the difficulty was entirely removed, and with it the prejudices of the blower, but in practice it was still found most desirable to take the iron from many stacks of the same brand rather than from one of two stacks only.

I have given in detail this personal reminiscence as showing what the prejudices were at that time, and what difficulties there were in removing them from the minds of men who, having practised under an old regime, could not, for some time, at least, appreciate the value, to himself and his work, of new ideas in which the analysis of the metals played an important part. As can most naturally be expected during the transition period, whenever the steel did not turn out satisfactorily the blame was put upon the chemist, and upon the new system, and there was often great desire expressed to go back to the older system.

What I have said may, perhaps, cause those who make good Bessemer steel to-day to ridicule the methods of the old system, and the prejudices held by practical men at that time, but I, for one, have great respect for these workers, and also for men in the iron foundry to-day who, having only their own past experience to guide them, naturally prefer to depend upon what they think they know, than accept what to them is incomprehensible.

THE APPLICATION OF CHEMICAL SCIENCE TO THE FOUNDRY.

The experience of the cupola foreman in the Bessemer shop, whose duty it was to melt mixtures of metal in the cupola, is not without value to modern foundry men, many of whom cling so fondly to the data they have laboriously obtained during a life's experience. It is unfortunate, however, that the pig iron maker cannot always supply him with pigs of constant composition, for although they may be equal in the appearance of the fracture, and the grading may be perfect, yet, for all that, they do vary to a very great extent in the amount of silicon and sulphur present, and the results obtained in the foundry necessarily vary to a corresponding degree. It follows that mixtures of one or two brands, which give good and perfect results at one time, will give imperfect work at another. The founder's experience is not at fault. It is the variable nature of the pig iron supplied to him which renders it of uncertain value. For that reason it behoves every foundry foreman to demand that he shall be supplied with the necessary properly laid out stock yard, and to have analysis of every stack of iron on the ground, and th[illegible] supplementing his valuable practical experience and knowledge he will be enabled to make his mixtures to the best possible advantage.

Much has been written from time to time on the requisite composition of castings for various purposes, and quite recently Professor Turner and Mr. Percy Longmuir have published several articles, lectures and papers on the chemical, physical, and microscopical side of foundry practice. It is, however, in America, where the greatest activity prevails in the application of chemical science to the foundry. In that country there are several Foundrymen's Associations and a Journal devoted exclusively to foundry practice which generally contains reports of deliberations and discussions of these societies, as well as reviews of work done in other countries.

Although more is heard of what is being done in the States than of works' practice at home, it is a fact that steady progress is being made in England, Scotland and Wales, which, although not talked of, is nevertheless bound to be felt on account of the better work turned out. My object is to direct attention of founders and others to certain necessary and fundamental conditions for carrying out foundry practice to-day, and to suggest a few definite lines which metallurgical chemists in foundries should follow in order that their services may have the maximum value both to themselves and their employers.

Those who prefer to work, on what may be called the hand-to-mouth principle, can have little or no use for a chemist, and cannot possibly make the best of progress, for they are completely at the mercy of the sender of the pig iron, who, if he supplies foundry iron of the grades specified, may send material with greatly varying properties.

Many works are so arranged that it is impossible to keep stocks, and they have no alternative but to feed their cupolas direct from the trucks or from the twenty or thirty tons of metal they have room to stock.

NEED FOR ANALYSES.

Their remedy is to demand an analysis from the maker of each brand, and accept only such iron as contains the specified quantity of silicon, etc. It has been the practice of hematite pig makers to test each cost and to stock according to the analysis, and there should be no difficulty in doing the same thing at furnaces making foundry iron.

Many furnaces in the future are likely to be driven much more rapidly than is the practice to-day, and as rapid blowing tends to the production of iron low in silicon, if such iron be sent out indiscriminately with the same class of iron made in the more slowly driven furnaces, the result will be chaos in the foundry.

Up to the present, foundry pig has been stacked, when put into stock for warrants or other purposes solely according to the grade of the fracture and not to analysis. I maintain that the time has come when this old time custom must be swept away, and it is the buyers of foundry iron only who have the power to effect the change, for by demanding chemical composition as well as fracture numbers, the makers will be obliged to meet them, but certainly cannot be expected to do so, if it is not asked for.

When ordering pig metal, it is very important that the analysis be demanded, and also where possible, that each day's delivery shall be taken from a single cast of iron, or if more than a single cast is sent in any one delivery, to have the trucks ticketed, so as to show the cast and analysis.

ARRANGEMENT OF STOCK YARDS.

The stock yards should be arranged in such a way that there is easy access from the cupola to the stacks of pig, and equally easy access from the railway sidings. Where many brands are used, the area required will necessarily be greater than when a small number are stocked. The arrangement of the stacks must depend upon the space available, and the work done. The system I should prefer is to make long rectangular narrow stacks, say 20 ft. to 30 ft. in length, 5 ft. in width, and 5 ft. in height. These should run parallel with the railway. In unloading the iron from two or three trucks at a time, the pigs should be spread equally over the 25 ft. by 5 ft. area, and this system should be continued when laying down the iron from sets or other trucks of the same brand, until the height of the stack of 5 ft. is reached. Samples having been taken, these should be sent to the laboratory for testing purposes, and no iron should be used from any stack until its average composition is known. In taking metal from them to melt in the cupola, what is removed should represent an average of every layer. This is done by working from one end of the rectangular heaps to the other.

When the first stacks are being worked up, duplicate stacks should be made, preferably opposite those of like brand, on the other side of the tram or railway.

The scrap iron should be stocked according to its fracture, and average analyses be made of the stacks laid down. Two separate stacks should be sufficient, one of good grey heavy scrap, and one for small rusty material.

(To be continued.)

Read before the Cleveland Institution of Engineers.

PNEUMATIC DRILLS.

Improvements introduced by the Consolidated Pneumatic Tool Company, Ltd.

THE Boyer hammer, fitted with hand or automatic rotating device (figs. 1 and 2) are designed for various classes of plug and feather work. They are made in three sizes, adapted for light medium, and heavy drilling, the best results being secured with an air pressure of 80 lb., at which pressure the hammers consume approximately 20 cubic feet of free air per minute. The difference in the two types lies in the rotating attachment. The hammer used is an improved type of the Boyer chipping hammer, No. 1.

The light weight of these machines admits of their being easily held by hand, and they are, therefore, available for either top or side-line work. As many as 131 holes ⅞ in. in diameter by 3 in. deep have been drilled in hard granite, with one of these machines in 140 min.; this time, including the lining, changing of drills, etc. On account of the light rapid blow employed, the drills do not require resharpening so frequently as in hand-drilling, and as many as 20 holes have been drilled without resharpening the bit. Type A of this hammer can be used to advantage with a special adapter for copper-stay cutting, the average time for knocking down ⅞ stays being about 45 seconds. The improved rock drills which the Consolidated Pneumatic Tool Company, Ltd., are just placing on the market are a combination hand and tripod rock drill, which combine features not as yet anticipated in similar machines now in use, including light weight, rapid stroke, compactness, and economy in air consumption, and adaptability for use either by hand or with a tripod. The device which they possess for freeing the hole from cuttings is a tube which envelops the drill bit and which, by means of a blast of cold air running through it, completely clears the hole of all obstructions. This arrangement is extremely valuable in cases where the class of rock being drilled does not necessitate the use of water, though they can be adapted for water connection, using hollow steel. The rock drills are very simple in construction, containing altogether only some 26 parts, all of which are made of hard tool steel—a radical departure in the manufacture of this type of machine. Owing to its light weight, the drill has been used by divers under water for submarine excavation work, the only alteration necessary being to make provision that the exhaust shall be discharged above water-level.

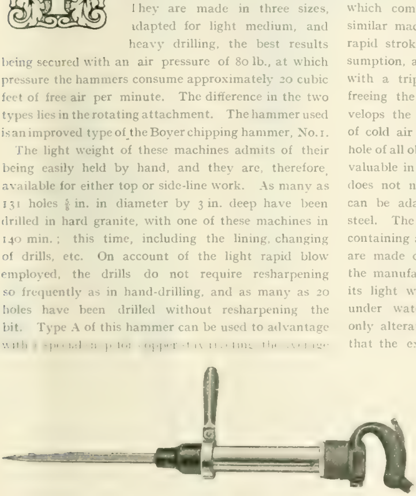


FIG. 1. BOYER HAMMER WITH HAND ROTATING DEVICE.

Size 1 × 4 adapted for light plug drilling.
1¼ × 1½ .. medium ..
1½ × 3 .. heavy ..

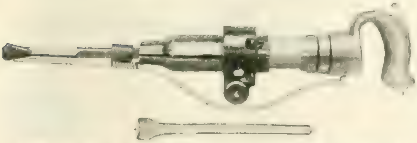


FIG. 2. BOYER HAMMER WITH AUTOMATIC ROTATING DEVICE.

This machine is made in two sizes, weighing respectively 45 and 25 lb. The larger size is shown in fig. 3.

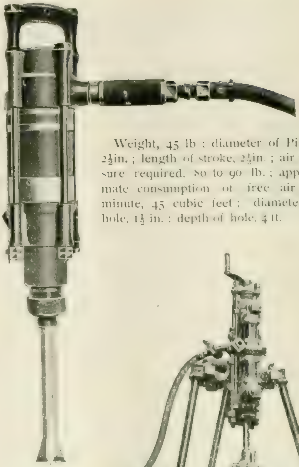
The torpedo rock drill (fig. 4) is a light, yet powerful, machine, which can be driven by either steam or air; it is made in three sizes, the diameter of the cylinder being 2¼ in., 2¾ in., and 3¼ in., and the weight of machine 120 lb., 195 lb., and 310 lb. respectively, their respective capacities [illegible] in., [illegible] in., and [illegible] in.

The valve mechanism of this machine is of an efficient yet simple character, and consists of a pair of Corliss type, located at either end of the cylinder and operated by means of a segmental rocker, actuated by means of an incline in the piston. This location of the valve reduces the clearance space between the valve port, and the cylinder to the minimum, and the maximum port opening is obtained for admission and exhaust. The drill runs at full speed on any stroke from 2 in. to the maximum. The smaller size is handled, by one man, and is used with either tripod or column.

The Little Giant ore-boring machine (fig. 5), is a standard pneumatic drill, and either the No. 1 Little Giant or No. 8 Whitelaw type, can be fitted with a split nut attachment, arranged as shown in the illustration. It will drill in iron ore containing 35 per cent. to 50 per cent. of iron 1¼ in. holes at the rate of 3 ft. deep per minute, the maximum depth of holes being 6 ft. (this depth being obtained by using three drill bits). The split nut is of a simple and efficient construction. The halves of the nut can be readily replaced when worn out. When drilling, the links are locked in the closed position, and both halves of the nut are opened by one movement of the links, so that the screw bar can be at once withdrawn from the hole and a fresh bit inserted; by means of the special swivel attachment, the machine not only always finds its alignment for drilling, but the whole machine can be swung out of the line of the hole, so that the drill bit can be withdrawn without removing the drill from the wedge-pin.

The total weight of the machine is 50 lb., so that it can be readily set up and operated by one man. The best results are obtained with a pressure of 80 to 100 lb., but the machine can be operated with 50 to 55 lb.; the air consumption at the lower pressure being about 20 cubic feet of free air per minute.

The No. 8 Whitelaw machine, fitted with split nut (fig. 6), averaged 40 holes 4 ft. deep, 1¼ in. diameter (this depth being obtained by using three drills of varying length) in one shift, viz., from 6 a.m. to 2 p.m. the iron ore containing 35 per cent. of iron, and the complete pressure 50 to 60 lb.



Weight, 45 lb; diameter of Piston, 2½in.; length of stroke, 2½in.; air pressure required, 80 to 90 lb.; approximate consumption of free air per minute, 45 cubic feet; diameter of hole, 1½ in.; depth of hole, 4 ft.

FIG. 3.

IMPROVED COMBINATION HAND AND TRIPOD ROCK DRILL, LARGE SIZE.

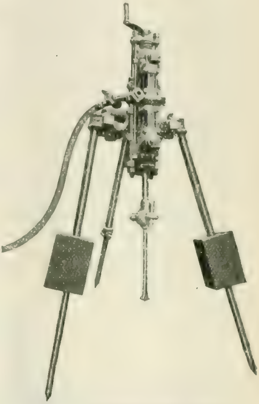


FIG. 4. TORPEDO ROCK DRILL.

The Whitelaw ore-boring drill, fitted with automatic withdrawal and refeed (shown in fig. 7), is one of the firm's standard Whitelaw reversible drills, fitted with a special attachment by means of which the screw bar cut with a very quick pitch, is driven by differential set of gears, which can be adapted to give any feed required from one-eighth of an inch per revolution, to any range which is [illegible] By means of the

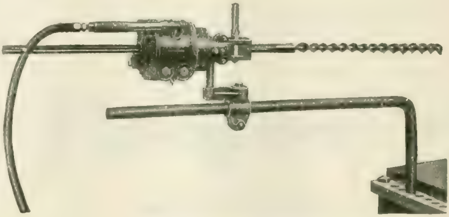


FIG. 5. LITTLE GIANT DRILL WITH SPLIT NUT.

The weight of the machine complete is about 60 lb.; it will drill at the rate of 3 or 4 ft. per minute. The screw bar can be withdrawn from the hole in about 10 sec. by means of the operator manipulating a clutch-lever, which is provided at the side of the machine, the machine during all these operations running continuously in a forward motion.

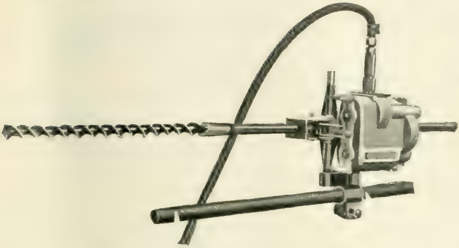


FIG. 6. WHITELAW DRILL WITH SPLIT NUT.

[illegible] withdrawal and refeed mechanism the clutch will slip, in the event of the [illegible] meeting an obstruction, and the drill will be automatically withdrawn, and refed after the drill has been retracted sufficiently to effect a clearance. This operation being quite automatic in its action, the resistance at which the clutch will slip can be easily regulated while the machine is running.

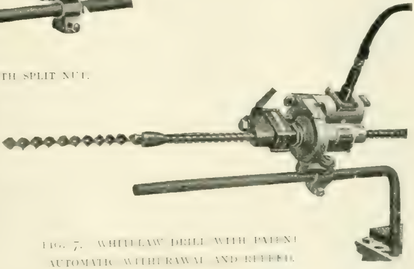


FIG. 7. WHITELAW DRILL WITH PATENT AUTOMATIC WITHDRAWAL AND REFEED.

OPENINGS FOR TRADE ABROAD.

Australia.

Tenders for the supply of the following railway materials will be received at the Supply and Tender Board Office, Adelaide, up to 5th April:—

348 bars of channel steel (two drawings, 1s. each); 54 bars of angle steel (one drawing, 1s.); 1,017 bars of angle steel (one drawing, 1s.); 11 bars of square root angle steel (two drawings, 1s. each); 12 bars of tee steel; 145 mild steel plates or bars; 540 mild steel plates; 1,470 mild steel plates, and 250 feet of iron chain.

Specifications may be seen in London at the office of the Agent-General for South Australia.

Orange River Colony.

A Board of Trade correspondent writing from [illegible]:—

"British manufacturers should look out for orders for pumping plants. The Government are realising every day the necessity for boring for water as much as possible, and the Land Settlement Department are offering drills [illegible] and have lately bought [illegible] Juniper drills, which are being operated with as fast as possible. As in many or most instances the water when found does not run out, and cannot be furrowed out, it is necessary to use a deep well pump with either steam, oil, wind, or horse-power."

Belgium.

Tenders are in demand until the 14th prox. for the construction of a railway between Lahamaide and Flobecq at the estimated cost of £9,000. A deposit of about £880 will be required to qualify any tender. Copy of the specification may be obtained from "M. le Directeur General, Societe Nationale des Chemins de Fer Vicinaux, 14 rue de la Science, Brussels."

Argentina.

The Government of the Province of Corrientes have submitted to the Provincial Legislature a scheme for the erection of a cotton ginning factory, and also a factory for the extraction of vegetable oils. Both factories, which are to be equipped with the latest appliances, are to be completed within two years from [illegible]

Ottoman Empire.

There will shortly be an opening here for railway plant, the Anatolia Railway Company having had surveys carried out with view to augmenting the line from [illegible]

SHIPBUILDING NOTES.

Five Clyde shipbuilders in the Admiralty list have sent in tenders, plans and models for the new yacht for His Majesty King Edward. The yacht will be smaller than the last one built, and it is understood that turbine engines are to be specified for.

A handsome typewriter for H.M. steam yacht the *Victoria and Albert* has been supplied by the Yost Typewriter Company, Ltd.

The new Cunard turbine liner *Carmania*, 678 ft. long, and of 21,000 tons gross tonnage, was successfully launched by Messrs. John Brown and Co., at Clydebank. She will have accommodation for 2,656 passengers, and is designed for a normal speed of 21 knots. Lord Inverclyde was present and the vessel was named by Lady Blythswood. The launch may be said to be the beginning of a new era in the transatlantic service, except as regards the machinery the *Carmania* is practically a replica of the *Caronia*, launched a fortnight ago. The latter vessel is fitted with quadruple expansion engines driving twin screws, while the *Carmania* will have triple screws driven by three separate Parsons' turbines. At the lunch which followed the launch, Mr. John Ellis remarked that the *Carmania* would afford an unique example of ascertaining the merits and demerits of turbine propulsion as compared with reciprocating engines. In the *Carmania's* turbines were one and a quarter million small brass blades.

The finely modelled steel screw steamer *Hillhouse*, built by the Northumberland Shipbuilding Company, Ltd., Howdon-on-Tyne, to the order of Messrs. John Cory and Sons, Ltd., Cardiff, for the Seville and United Kingdom Carrying Company, Ltd., left the Tyne for her trial trip, which proved in every way satisfactory, a speed of 11 knots being easily obtained. After the trial trip the s.s. *Hillhouse* sailed under the command of Captain Williams for Cardiff.

On Friday, the steamer *Netherton*, built by the Northumberland Shipbuilding Company, Ltd., Howdon-on-Tyne, to the order of Messrs. John Greenlees and Co., Glasgow, left the Tyne for her trials. She is 372 ft. long by 48 ft. beam and 30 ft. 10 in. deep, and has been built under special survey to the highest class at Lloyd's, spar deck rule with extra strengthening for special freeboard. She is fitted with long poop, long bridge, top gallant forecastle, the accommodation which is very ample being all placed in steel houses on the bridge deck. The 'tween decks are lofty and so arranged that cattle, troops, or emigrants may be carried if necessary. Very special attention has been paid to the loading and discharging gear, and a complete outfit for the rapid handling of cargoes has been arranged for, consisting of eight steam winches by Messrs. Clarkes Chapman and Co. Ltd., Gateshead-on-Tyne, a large number of cargo derricks, steam steering gear by Messrs. Caldwell and Co., Glasgow, and steam windlass by Messrs. Emerson, Walker and Thompson, Bros. She is of course fitted with the usual water ballast arrangements for light passages. The vessel has been constructed to a fine model with a view to rapid speed and economy in fuel, and the machinery (consisting of engines with cylinders 24½ in., 40 in. and 68 in., by 48 in. stroke, three large boilers 13 ft, 9 in. by 11 ft., with 180 lb. working pressure), has been supplied by The North Eastern Marine Engineering Company, Ltd. The steamer will carry about 7,000 tons loaded. She is a duplicate of the three *Queen* steamers already built by this firm for Messrs. Thomas Dunlop and Sons, Glasgow. During construction the *Netherton* has been superintended on behalf of the owners by Mr. Broom and Mr. McIntosh.

The trial trip proved in every way satisfactory, and a mean speed of over 12 knots was easily obtained. Among the guests on board were the following: Messrs. John and Thomas Greenlees, Thomas Dunlop, A. H. Buchanan and T. M. Broom, Glasgow, Mr. Kightley, Newcastle, Mr. Rowland Hedge, and Mr. J. Graham, representing builders, Mr. D. Myles, representing engineers, and Messrs. Champness, Heck and Finlay, Lloyd's surveyors. After the trial the *Estherton* sailed under the command of Captain Simpson for the Bristol Channel

RUNNING-SHED NOTES.

IV.—By J. C. R. Adams.

WHEN the engine is supplied with automatic expansion gear, consisting, as is now most commonly the case, of a swinging link worked by the expansion eccentric, the radius-rod from the expansion-valve spindle is pivoted to a die capable of sliding in the curved slot of the link from top to bottom, and the point of cut-off is determined by the height of the die in the link as fixed by the position for the time being of the governor sleeve, to which it is connected by a lever and suspension-rod.

There is an apparent difficulty in connection with this arrangement, owing to the error in the piston's movement caused by the angularity of the connecting-rod, which may be worth clearing up. It is the practice in designing valve gears, as a rule, to assume the connecting-rod of infinite length, in other words, to consider the piston's movement in relation to the crank as alike at the two ends of the stroke. Let us first state the problem and then see how the valve gear I have mentioned can be adjusted to redress the inequality in the movement.

Taking a horizontal engine for example, and assuming uniform rotation of the flywheel, the two halves of the revolution (supposed to be divided by a vertical diameter of the crank-pin circle) are performed, of course, in equal times; but, owing to the action of the connecting-rod, which translates these equal divisions of the crank-circle into unequal fractions of the piston's stroke, the mean velocity of the piston is much greater while the crank is performing the half-revolution next to the cylinder than during the corresponding half furthest away from it. If the connecting-rod is, say five cranks long, the piston's velocity just before and after the beginning of the stroke at the end furthest from the axis of the crank shaft, is 50 per cent. greater than in the corresponding positions at the other end; these differences rapidly diminishing as the stroke proceeds, until at near mid-stroke they, of course, disappear.

Now, putting aside the automatic gear for a moment, suppose a single slide valve with an eccentric adjustable for different points of cut-off, but giving a constant lead. If we turn the engine round to each of the two dead centres in turn and lengthen or shorten the eccentric-rod until the lead (or amount the steam-port is open at the dead centres) is the same at each end, we shall find that to secure an equal length of admission at both ends of the stroke, the eccentric-rod will have to be lengthened, so as to move the slide-valve further away from the crank; a little only if for an early point of cut-off, but a good deal, comparatively, speaking, for a late cut-off; and so *pro rata*, for all points in the stroke.

Now, in the automatic expansion gear, where the point of cut-off is constantly varying (that the variation is performed upon the second or outer valve makes no difference in the principle) we are, in effect, called upon to be continually altering the virtual length of the expansion eccentric-rod if we wish to secure symmetrical indicator-cards for all points of cut-off within the range of the gear. How is this rather difficult condition fulfilled in practice?

The engine is left by the erector with the link swinging through equal arcs on each side of a vertical line dropped through its centre of suspension; and if indicator diagrams are taken under these conditions, it will be found that though a pair of symmetrical diagrams can be got for any one point of cut-off, by adjusting the length of the valve-spindle or the radius-rod, yet they become unequal the moment the governor causes a change in the cut-off.

This can be corrected by increasing the length of the expansion eccentric-rod to an amount found by trial when taking the indicator cards. The effect of this adjustment is to cause the expansion link to swing or vibrate through a longer arc on the side nearest the cylinder (or, in other words, to incline the link a little towards the cylinder), with the result that as the radius-rod is raised by the governor, not only is the travel of the valve reduced giving an earlier cut-off, but the virtual length of rod is reduced also in corresponding degree, and *vice versa*. We are thus able to get symmetrical cards from the two ends of the cylinder at any and every point of cut-off.

Before leaving the governor, we must note that it is a *sine qua non* that the expansion valve be set to cut off at zero, when the governor sleeve is in its highest position, or accurate governing cannot be secured.

CORRESPONDENCE.

To the Editor of Page's Weekly.

DESTRUCTORS AND ELECTRICITY.

Dear Sir,—Owing partly to the publication of a very instructive paper, read by Mr. W. P. Adams, before the Institution of Electrical Engineers, public interest in the above question has been considerably stimulated. I think, therefore, that it may be not out of place to point out, with your kind permission, some misconceptions which may arise.

There is a tendency in some quarters to estimate the efficiency of any particular destructor by the number of electrical units per ton of refuse which are produced in the works where such destructor is in use.

The number of units which are produced per ton of refuse burnt depends chiefly on the following factors :—

1. The calorific value of the refuse.

2. The conditions as to day and night load, which determine whether all the refuse is used for steam raising, or whether the destructor is working at full power, while the electricity plant is practically idle.

3. The efficiency of the electrical generating plant, which may require more or less steam per unit generated.

4. The efficiency of the destructor plant, with its boilers and flues.

5. Last, but not least, the efficiency of the management.

It is, therefore, absurd to attribute to the destructor, either the whole credit for a good result in units per ton, or the whole blame for a poor result, and this is demonstrated by the fact that you will find one destructor of a given make giving a very high figure, and another destructor of the same make, but under different conditions, giving a low figure.

One of the most important factors in the efficiency of a destructor, the cost of labour, is usually ignored when dealing with steam raising results. In any destructor, increased steam raising results can usually be obtained by putting on increased labour, and "stoking in spoonfuls." From the steam raising point of view, the all important question is, what is the cost of a ton of steam produced by the destructor in ordinary everyday work ?

Under the heading "Steam from Refuse and its Cost," one of your contemporaries published last year some interesting figures, showing the cost of labour per ton of steam, as well as the evaporation per pound of refuse ; at a number of combined stations. It was shown that those stations where the highest evaporative results are obtained are not always the most economical, owing to the large expenditure in labour, and it is noteworthy that among those stations where utilisation of steam is complete the best result came from Fulham.

If the destructor produces a supply of steam at a reasonable cost for labour, it is for the electrical department to utilise that steam, and the credit for good results and the blame for bad results belong by rights to the engineers who are responsible for the construction and management of the whole combined works, and not to the maker of any particular part of the installation. I think that if the above facts were more generally recognised, it would be in the interest alike of electrical engineers, destructor builders and the public.

I am, dear Sir, yours faithfully,

F. L. Watson, A.M.Inst.C.E.

OBITUARY.

The late Mr. Gabriel James Morrison, M.Inst.C.E., was intimately associated for many years with the development of railways in China, having gone out to the East as engineer of the first railway laid down in Chinese territory. Subsequently, Mr. Morrison established himself in business at Shanghai as a civil engineer, and his firm of Morrison and Gratton, was associated with many important engineering works in Shanghai. After his return to England Mr. Morrison acted in conjunction with Sir John Wolfe Barry as consulting engineer to the Shanghai-Nanking railway. As a matter of historical interest, it may be mentioned that Mr. Morrison was present at the laying of the first Atlantic cable.

The death is recorded at the early age of thirty-eight of Mr. Frank T. Marshall, director of Messrs. R. and W. Hawthorn, Leslie, and Co., Ltd., who had charge of the marine engine works of that firm.

Mr. James Frederick Jackson, who died suddenly at Torquay, was a member of the firm of Messrs. Spear and Jackson, steel manufacturers, Etna Works, Sheffield, and son of the late Alderman J. B. Jackson, who had been mayor and master cutler of Sheffield.

INSTITUTION OF MECHANICAL ENGINEERS.

MR. EDWARD P. MARTIN ELECTED PRESIDENT.

THE annual general meeting was held on Friday last in the hall of the Institution, Storey's Gate, S.W., Mr. J. Hartley Wicksteed presiding.

The Chairman moved the adoption of the report, extracts from which appeared in the last issue of PAGE'S WEEKLY. He said he would like to emphasise one paragraph of the report, which has been read by the Secretary, with regard to the letters used to indicate membership of the Institution. It was suggested that instead of using the letter M, members, associate members and others should use the word Mech., so that the proper description of a member would be M.I.Mech.E. Members might be quite certain that this suggestion was not made without good reason, and it was hoped that the recommendation of the Council would be followed.

Mr. Edward P. Martin seconded the resolution for the adoption of the report, which was unanimously carried.

The Secretary (Mr. Edgar Worthington) announced that, as a result of the ballot, Mr. Edward P. Martin had been elected President for the ensuing year, Mr. Arthur Keen and Sir William T. Lewis, Bart., as Vice-Presidents, and the following members as Council: George J. Churchward, Henry Davey. William Dean, H. Graham Harris, The Right Hon. W. J. Pirrie, LL.D., Sir Thomas Richardson, Mark H. Robinson.

Mr. J. Hartley Wicksteed: It is now my duty to vacate this chair, and, in doing so, I have the greatest pleasure in inviting Mr. Martin to be my successor. Mr. Martin is a man who has been salted; he has already been President of the Iron and Steel Institute; he is a man of large experience, and great travel, being acquainted with nearly every quarter of the globe, where mechancial engineering is practised, and he has been, I may say, in pickle by the Council for this position for several years. Up to the present time, however, his energies have been entirely absorbed in enormous responsibilities in connection with mechanical engineering and iron and steel making, but now that he is getting easier in respect of his obligations in industrial affairs, he is able to devote some of his boundless energy to the good work of conducting and guiding the prosperity of this Institution. I could have vacated the chair in favour of no one with greater pleasure than I do in favour of Mr. Martin.

Mr. Edward P. Martin then took the chair as President.

VOTE OF THANKS TO THE RETIRING PRESIDENT.

Dr. Kennedy: Mr. President and gentlemen,—While congratulating ourselves on our new President, and our new President on his election, it is at the same time my pleasureable duty to move a resolution of thanks to the retiring President, Mr. J. Hartley Wicksteed, for the excellent manner in which he has filled the office of President during the past two years. That motion does not require that I should make any long speech; you yourselves have seen Mr. Wicksteed frequently during his period of office, and you know what he has done. I was looking at the chart which is hanging on the wall of this hall, dealing with the growth of membership of this Institution, and I studied with particular interest the figures for the years 1894 and 1895, when I had the honour of being your President, and I cannot help noting, although I thought we worked very hard in those days, that the great increase of membership has taken place since that time, and it is plain to me that, though I found the duties of President for two years somewhat laborious, Mr. Wicksteed, with this increasing membership, found these duties much more severe and arduous than they were when I had the honour of occupying the chair. In addition to carrying out the duties of President of the Institution at home, there fell upon Mr. Wicksteed this year the duty of representing the Institution in America during our official visit. This was no light task, gentlemen, but Mr. Wicksteed fulfilled it in a manner which merits our heartiest thanks, while I am pleased to say that, in representing the Institution, Mr. Wicksteed made himself extremely popular on the other side. Another fact to which I should like to direct attention is that in Mr. Wicksteed we returned to something more like the typical mechanical engineering President of the old days of this Institution. I am very glad that Mr. Wicksteed has occupied the chair of this Institution and filled it, as I have said, with so much ability and credit to himself and to us. I move a cordial vote of thanks be accorded to Mr. Wicksteed for the way in which he has performed his duties as President of this Institution.

Mr. Maw seconded, and the new President (Mr. Martin) supported the resolution, which was carried with acclamation.

Mr. Wicksteed: I thank you very heartily for this expression of good will and appreciation and for the kind remarks made by Dr. Kennedy, Mr. Maw, and the President, and I am very pleased to hear that my friends in America [illegible] I know that I formed a very cordial relationship with the President of the American Society, and many others whom I met on the other side, and I [illegible] that I [illegible] worthy representative of this great Institution. The President has touched upon a thing on which I have, perhaps, prided myself more than anything else, and that is the character of the meetings and discussion which have taken place in this hall, under my presidency. I have on many occasions seen this hall so full when our papers have been read and discussed as to cause misgivings as to whether in a short time it would not be too small, and I think I may say that during my term of office the interest in the papers and discussions has never flagged. Reference has been, made to the arduous character of the duties performed but I must say, and it will be an encouragement, I hope, to my successor, that I have not found it in the least degree a strain, but a pleasant relaxation. I have, during my long career, been subjected to eight contested elections, and it is by a process of survival and longevity, that I have lived to fill the office of President. My position, however, is now fairly secure, as I belong in future to the House of Peers, and shall in future be subjected to no interference in the shape of contested elections. I have to thank the members of the Council for the assistance they have rendered me during my term of office, and you, gentlemen, for the kind way in which you have received this resolution.

TRAMWAYS PERMANENT WAY CONSTRUCTION AND MAINTENANCE.

A paper on this subject was read before the Leeds Local Section of the Institution of Electrical Engineers on the 16th inst. The following is a brief abstract. The author expresses a preference for girder rails weighing 96 lb. per yard, with fish plates 25 in. long weighing 70 lb. per pair, and anchored down at the joints with Howard Cooper's patent joint, 24 in. long, with six rivets into the bottom flange of each rail. He has also used an intermediate anchor, either one similar to those at the joints, or the Ames Crosta Bull Dog Anchor block. The author gives it as his strong opinion that it is better to lay the metals first and the concrete afterwards. The metals should be placed on wooden blocks packed up with wedges to the exact level, at intervals of about 9 ft. apart, then the line crowed, afterwards the concrete is packed under the metals and the remainder of the track to the level of the bottom flange of the rail. After this has stood for two days the wooden blocks are taken out, and the holes filled in with concrete, and the following day the whole of the crevices under the metals are run in with a mixture of sand and cement (1 to 1).

The author has used rails 60 ft., 45 ft., and a few 35 ft. long, but prefers the 45 ft. lengths as being more readily handled, while there is not the danger of sagging which occurs with a longer rail. Moreover, the 45 ft. rail only requires one intermediate anchor, whereas the 60 ft. rail ought to have two to each rail.

The fishplates should be rolled from the same quality of steel in all respects as that specified for the rails. They shall be capable of being bent, when cold, round a bar [illegible] in. in diameter without fracture

THERMIT WELDING PROCESS.

The engineer must be very careful in the gauging of the rails or it is a great strain on the wheels of the cars. The gauge on curves should be slightly less, varied according to the sharpness of the curve. The author has used both manganese and crucible cast steel points and crossings, and thinks the former has a longer life. When occasion arose for relaying the track at Halifax, the author had the whole of the joints welded on the Thermit process.

He had some tests made of the electrical resistance of Thermit welding and otherwise, with the following results: Taking a solid rail 8 ft. long as a standard resistance, ·000068 ohms; with Thermit welded joint, without bonds, same length, ·000072 ohms; with Thermit welded joint, with one bond, same length, ·000067 ohms; fishplates, sole-plate, and two bonds, newly constructed, ·000078 ohms; fishplates, sole-plate, and two bonds, after two years, ·000095 ohms.

The welded joint has a considerable value mechanically by giving increased strength to the track..

Reference is made by the author to the need for every engineer having under his control the construction and maintenance of permanent way, possessing an emery rail grinder. The one in use at Halifax is, up to the present unique, it being the only one of its kind so complete. It was built by Messrs. Ames, Crosta and Co., Nottingham, specially for Halifax, and is fitted up with an electric motor, so that it can travel and work from the overhead wire. It is also fitted with a twelve h.p. petrol motor, and can travel and grind from this, if the overhead equipment is cut off, or in case of construction where the equipment has not been completed. The machine is fitted up with a complete set of drilling apparatus for drilling longtidudinally and vertically, or, if required, at any angle which is very useful and it can be run from either motor.

MICROSTRUCTURE OF CAST IRON.

At the last meeting of the Iron and Steel Institute Mr. O. F. Hudson read a paper on this subject. The following is an abstract of a portion of the paper, dealing with the manner in which specimens are prepared:—

The specimens for micro-examination are taken when possible by sawing a small piece from the metal to be examined. In the case of mottled and white iron such a course is not possible, and the specimen has to be taken by chippings. The specimen may conveniently be of the following dimensions: [illegible] in. × $\frac{5}{8}$ in. × $\frac{3}{16}$ in. One of the large surfaces is then made perfectly plain by filing with a smooth file, and the edges bevelled to prevent tearing of the polishing papers. A smooth-filed, clear, perfectly plain surface having thus been obtained the file marks are removed on fairly coarse emery paper, and the polishing continued on emery papers of increasing degrees of fineness. The final polishing and removal of all scratches is done on chamois leather, moistened with a thin paste of the finest rouge, or better still with alumina obtained by the calcination of ammonium alum. Alumina is much more effective as a final polisher than rouge, and for cast-iron work is very easily prepared. It is usually recommended for general purposes that the alumina should be ground and graded by careful levigation, and the products made into pastes with the finest Castile soap. A polishing powder that answers admirably for the final polishing of cast-iron may be made by calcining ammonium alum in a porcelain dish in a muffle and lightly grinding the alumina so obtained, the powder being dusted unto moistened chamois leather for polishing.

An examination of the specimen after final polishing, and before etching often gives useful information, *e.g.*, the amounts and relative distribution of graphite and phosphide eutectic in grey phosphoric irons. In etching specimens of cast-iron there is a fairly wide choice of reagents that give satisfactory results, but perhaps the most convenient are either

(*a*) a 2 per cent. solution of nitric acid in water or alcohol, or

(*b*) a 5 per cent. solution of picric acid in alcohol.

To avoid misleading results etching should be conducted with discretion, and the specimen should be examined under high and low powers, the etching being, if necessary, continued further, or the specimen repolished and re-etched. After etching the specimen may, with advantage, be rubbed lightly on parchment covered with a thin paste of precipitated calcium sulphate.

INSTITUTION OF CIVIL ENGINEERS.

The annual dinner of the Yorkshire Students' Association of the Institution of Civil Engineers was held at the Queen's Hotel, Leeds. Mr. Ewing Matheson, M.Inst.C.E., presided, and among those present were the Lord Mayor of Leeds (Mr. N. Armitage), Sir Alex. N. Binnie (Vice-President, Institute of Civil Engineers), and Dr. Tudsbery (Secretary, Institute Civil Engineers). Sir Alex. Binnie replied to the toast of the "Institution of Civil Engineers," and Dr. Tudsbery proposed the "Association of Yorkshire Students," which was suitably acknowledged by Mr. Matheson.

LEEDS UNIVERSITY ENGINEERING SOCIETY.

At a recent meeting of this society, Dr. J. T. Nicolson read a paper on "High-speed Tool Steel and the Lathes for its use." He explained that he did not intend to deal so much with high-speed cutting steel as with the forces exercised during the operation of cutting. He alluded to the discovery that tool steel may advantageously be heated up to 2,000 degrees F., if properly cooled afterwards. He analysed the form of a chip cut at dead-slow speed and showed what happens precisely at the point of the tool. Experiment and observation show that 70 degrees is the most effective degree of sharpness, and that to work at high speed, within certain limits, is conducive to the life of a tool. At slow speeds it is the point of the tool which does the work, but at higher speeds the point is kept cool, and the work is done behind the tool point. The lecturer described the dynamometer used in measuring the forces exercised in all directions during cutting. It has been found that stress is constant whatever the area cut; that the forces required to sustain the tool when taking a cut are proportional to the area of the point of the tool, quite apart from the form of the cut, and that the force does not depend on the speed of cutting.

At a recent meeting of the Dundee Institute of Engineers there was an interesting discussion on the problem whether it would be more economical for Dundee mills to take power from a central electric station, or to drive by their own engines. Figures were submitted showing the relative costs of driving local mills by steam and electricity, and in the cases quoted there was shown a considerable economy to be gained by steam driving. Mr. Henry Richardson, the city electrical engineer, opened the discussion.

TECHNICAL SOCIETY NOTES.

The American visit of the Institution of Mechanical Engineers was again the subject of discussion at the last meeting, and the comparisons made, while admitting the high place taken by American engineers in the domain of mechanical engineering, certainly brought out nothing which puts Great Britain in the second place. As Mr. Thompson suggested, differences in design are not necessarily improvements, and he expressed himself unable to understand why American engineers had reversed the continental practice in pump engine construction with regard to the placing of Corliss and poppet valves. The only explanation which Mr. Barr, author of the paper on "American Pumping Machinery" could offer was the necessity for large ports and small clearances.

With regard to the duties obtained from pumping engines, Mr. Thompson who spoke from long practical experience, said it was the fashion to assume that American duties were much better than those obtained on this side, but in making that assumption, the difference in the sizes of pumping engines constructed in America, and in this country, was not taken into consideration. It was pointed out that while American engines ran up to 1,000 h.p., the engines in use here were not often more than a third of the size, and taking that fact into consideration, the duty obtained from English-made engines compared very favourably with those of American construction. Mr. Simpson, who spoke later on the same subject, was of a similar opinion. It is all a matter of opportunity, and if British waterworks companies and other corporate bodies would give English engineers a chance of building an engine of 1,000 h.p., the results obtained would be as good as those referred to in Mr. Barr's paper. And Mr. Barr himself, catching the infection, said that given equal chances, English engineers would surpass their American cousins.

Mr. Hartley Wicksteed told an interesting story of his visit to the McGill University at Montreal, which bears upon the same question of British and American engineers, and as to whom belongs the pride of place. It appears that visitors to the University find as part of the equipment of the mechanical laboratory an elaborate experimental engine, with so many cylinders and cranks and designed for so many varied purposes that even Mr. Hartley Wicksteed, with all his experience, failed to keep count. The point of the narrative is that this engine to which the attention of visitors is directed with no little pride of possession, was designed ten years ago by Mr. Druitt Halpin, the well-known English engineer, and still holds its own with anything which America can produce. Mr. Halpin was there in person to modestly confirm the truth of Mr. Wicksteed's narrative.

Mr. Alfred Saxon, author of the paper on "Engines at the Power Stations and at the St. Louis Exhibition," gave the meeting some instructive figures with the aid of diagrams. Some surprise had been expressed at the figures quoted by Mr. Saxon in his paper, but good as were the results given as achieved by American engines, Mr. Saxon was able to show that British engineers can better them. At the present moment there are being built in Lancashire for the London County Council four sets of engines rated at 5,000 i.h.p., working under normal load, and capable like the American engines described in Mr. Saxon's paper, of working under 50 per cent. overload, and the duty which the English-built engines are expected to perform will be 12½ per cent. in excess of the American engines referred to. English engineering having thus been vindicated all round, the new President, Mr. Martin, very opportunely closed the meeting.

Professor Lilly's paper on "The Strength of Columns," which figured in the agenda, had to be held over until a subsequent occasion. The next meeting of the Institution will be an important one, as the report of the Steam Engine Committee is to be presented.

A paper on "Brakes" was to have been read a the last meeting of the Tramways and Light Railways Association, but a paper by Mr. Herbert Jones, on the working results of the Waterloo and City Railway took its place.

The new paper on the agenda at the Institution of Electrical Engineers' meeting yesterday was "Setting Type by Telegraph." This paper, and the discussion on Mr. Addenbrooke's paper, "The Value of Overhead Mains," will be dealt with in the next issue of Page's Weekly.

Abstracts of the papers read at the Institution of Civil Engineers on the 14th inst. are now available. Mr. E. F. C. Trench, M.A., contributed a paper on the "Alfreton Second Tunnel," and Mr. D. McLellan's contribution to the Transactions was on "The Reconstruction of the Moncreiffe Tunnel." The Alfreton tunnel is, of course, on the Midland, and the Moncreiffe is the well known Caledonian tunnel near Perth.

At the Society of Arts on Monday last, Mr. Dugald Clerk delivered the second of the Cantor lectures on the "Internal Combustion Engine."

CONTRACTORS' NEWS.

We shall be pleased to insert under this column, free of charge, particulars of open contracts.

CONTRACTS OPEN.

Last Day

Copenhagen.—Supply and erection of a gasometer of a capacity of 200,000 cubic feet per hour for the Lighting Department of the Corporation. Valby Gasworks, Valby, Copenhagen ... . Feb. 27

King's Lynn.—Supply and erection of one 200-kw. steam dynamo, condenser, steam and other pipes for the Corporation. Mr. John Pilling, M.I.E.E., Electricity Works, King's Lynn. ... ... Feb. 28

Hull.—Supply of mains and cables for 12 months, for the Electric Lighting Committee. City Treasurer, Town Hall, Hull. Mar. 1

Barcelona.—The "Gaceta de Madrid" of January 18th contains a notice calling for tenders for the supply and installation in the sheds of the Barceloneta wharf of two transhipment cars for platform cranes. Conditions of contract and plans may be inspected at the offices of the Secretary of the Port Administration, Casa Lonja, Barcelona ... ... March 1

Glemsford (Suffolk).—Six contracts in connection with water supply. Particulars of the Engineer, Mr. J. T. Eayrs, Clarence Chambers, Corporation Street, Birmingham ... ... Mar. 1

Wimbledon.—Supply of stores to the Electricity Department for one year from April 1. Electrical Engineer, Durnsford Road, Wimbledon ... ... March 4

Johannesburg.—Supply of 100 electric cars, two electric water-cars, five-ton crane, car traverser, and workshop tools for Municipal Council . . March 6

Manchester.—Laying underground telephone pipes (Contract No. 11), with other appurtenant works for the Paving, Sewering, and Highways Committee. City Surveyor's Office, Town Hall, Manchester Mar. 6

Stoke Newington.—Supply, delivery and erection of sub-station plant and mains. Four-section contract. Mr. W. F. Loveday, Borough Surveyor, Town Hall, Milton Road, Stoke Newington, S.E. ... ... March 8

Broadstairs.—Construction, delivery, and erection at the above station of a horizontal tandem compound engine, condenser, well pumps, and all accessories. Mr. Percy Griffith, M. Inst. C.E., 54, Parliament Street, S.W. ... ... Mar. 11

Brighouse.—Widening of the Calder Bridge, Brighouse, by means of steel lattice girders and steel stanchions for the Corporation. Mr. S. S. Haywood, Borough Engineer, Municipal Offices, Brighouse ... Mar. 11

Belgium.—The "Bulletin Commercial" announces that the Belgian State Railways invite tenders for the installation of two sets of ventilating and heating apparatus in the central workshops at Mechlin. Particulars of M. Slaghmuylder, Engineer-in-chief, Station du Nord, Brussels .. March 6 March 13

Park Royal.—Supply, delivery, and erection of plant in connection with the electricity generating station at Park Royal and proposed sub-stations and distributing centres at various places, for the Great Western Railway Company. Messrs Kennedy and Jenkin, 17, Victoria Street, S.W. ... ... March 13

South Shields.—Supply, delivery and erection of the following plant in connection with the electricity supply department:—One multitubular marine type boiler, two medium-speed open-type vertical engines for two 550 k.w. direct current traction generators, two 500 k.w. direct current generators and traction switchboard. Mr. J. H. Cawthra, Borough Electrical Engineer March 13

Axbridge (Somerset).—Supply of about 600 tons of cast-iron socket water-pipes 7-in. to 4-in in diameter, for Axbridge Union Rural District Council ... ... Mar. 13

Llandyfodwg and Llantrisant (Wales). The Ogmore and Garw Urban District Council invite tenders for two distinct and separate schemes of bridging the valley at Gilfach, by extending Coronation-road, Evanstown, in the parish of Llandyfodwg, to join the highway known as Gilfach-road, in the parish of Llantrisant Mr. H. Dawkins Williams, Surveyor, Bryn, Menin . ... Mar. 14

London.—Supply of electrical stores for year ending March 31, 1906, for the Fulham Borough Council. Town Clerk, Town Hall, Fulham... ... ... Mar. 15

Shanghai.—The Shanghai Municipal Council invite tenders for the construction and operation of about 24 miles of electric tramways on the trolley system in the streets of the Settlement of Shanghai; alternative proposals are desired for the single-trolley and double-trolley lines. Council's agents, Messrs. John Pook and Co., 63, Leadenhall Street, London, E.C., and Messrs. Fearon Daniel and Co., 90, Wall Street, New York. ... ... March 31

Newport (Mon.).—Construction of main outfall and branch sewers for the Western Valleys Sewerage Board. Particulars at offices of Mr. Baldwin-Latham, Parliament Mansions, Victoria Street, S.W.; Mr. Geo. Chatterton, 6, The Sanctuary, Westminster, S.W.; or Mr. T. S. Edwards, Clerk to the Board, Newport, Mon April 8

COMING CONTRACTS.

Aston.—The Town Council has adopted a scheme for reconstructing and converting the remaining tramways in the borough at a cost of £63,270.

Devonport.—The Local Government Board has sanctioned the borrowing by the Corporation of £7,958 for extending the electric supply plant.

Sunderland.—The Corporation has decided to apply for sanction to borrow £15,000 for electric supply purposes.

Swinton and Pendlebury.—Application is being made by the District Council for sanction to borrow £6,900 for electric supply purposes.

West Hartlepool.—The Local Government Board has sanctioned the borrowing by the Town Council of £13,310 for electric supply purposes.

Switzerland.—Projects for three electric tramway routes have recently been approved for Berne, and an electric railway from Aigle to Sepey, Leysin and Feydey is to be constructed. For this latter project particulars can be obtained from the Aigle-Ollom Monthey Railway Company, Aigle, Switzerland.

Guatemala.—The tramway lines are to be converted to electric traction. Further information can be obtained from Mr. Richard Echeverria, Guatemala City.

Egypt.—Amongst the estimates for 1905 are: irrigation works, £953,000; bridges, £100,000; harbour works at Alexandria, £158,000; harbour and railway works at New Suakim, £150,000.

Copenhagen.—A scheme for doubling two railway lines and for constructing a high-level bridge over the Little Belt is under consideration. The estimate is about £4,000,000.

Chelsea.—The Council's application for sanction to borrow £29,000 has been before the Local Government Board.

Cupar.—The Town Council have under consideration a drainage scheme estimated to cost £10,000.

CONTRACTS CLOSED.

Islington.—The Borough Council have placed an order for seven 30-k.w. single-phase transformers with Messrs. Farranti, Ltd.

Little Halton, Bolton.—Orders have been recently received by Edward Dennis and Co., Ltd., from the Corporations of Birmingham, Burton-on-Trent, Coventry, Dewsbury and Middlesbrough. Orders have also been received from the Metropolitan Electric Supply Company, and the Stirling Boiler Company.

Buncrana, Ireland.—James Gordon and Co. have secured the contract for the supply, delivery, and erection of the complete hydraulic and gas power plant for the electric light station at Buncrana, Ireland.

Dublin.—Messrs. Davis-Perrett, Ltd., have received an order from the Dublin United Tramways Company for one of their electrical grease separating plants, capable of purifying 4,000 gallons of greasy water per hour, and have just installed a plant at the South London Electric Supply Corporation's works at Loughborough Junction to deal with 8,000 gallons of greasy water per hour.

War Office.—The Brightside Foundry and Engineering Company, Ltd., Sheffield, have received the order for heating the new War Office buildings in Whitehall. The system to be adopted is low-pressure steam heating, with radiators.

London.—The Paterson Engineering Company, Ltd., London, have recently received orders for Paterson feed-water purifiers from the following firms: Babcock and Wilcox, Ltd., Belliss and Marcom, Ltd., Danks and Co., the Electric Construction Company (2), the Mirrless Watson Company, Crompton and Co., and the Earl of Rosslyn's Collieries Company, Ltd.

Japan.—The Japanese Government have placed a contract with the North British Locomotive Combine, Glasgow, for fifty powerful locomotives. These are in addition to an order for a score of engines at present building for Japan.

London.—The Brush Electrical Engineering Company have received orders from the Middleton Electric Traction Company, J. J. White and Co., of Belfast, Keighley Corporation, Rochdale Corporation, and Erith District Council. The Erith order is for an overhead electric equipment, the other orders are for carbodies with Brush equipments.

Zurich.—The Horsfall Destructor Company, Ltd., of Leeds, have supplied a destructor installation to the town of Zurich, Switzerland; this installation comprises twelve cells, in which 120 tons of refuse can be burnt daily as it is collected, and without any addition of fuel.

APPOINTMENTS VACANT.

	Last Day.
Great Western Railway.—Electrical Engineer for traction and lighting. Salary, £600 per annum. The Secretary, Paddington Station, London, W.... ...	Feb. 27
Northampton.—Engineering Assistant under Corporation. Salary £100. Particulars of Borough Engineer	Feb. 28
Leeds.—The City Council have decided on the appointment of a waterworks engineer, at a salary of £1,000; Mr. Robert Fox, Town Clerk	Feb. 28
Chiswick.—Engineering Assistants under Urban District Council. Particulars of Mr. Ernest F. Collins, Town Clerk, Chiswick	March 2
London.—Assistant at the City and Guilds Central Technical College, to teach mechanical drawing and mechanism. Salary £150 per annum. Prof. Dalby, at College, Exhibition Road, S.W.	—

APPOINTMENTS FILLED.

Bradford.—Mr. Charles W. Salt, of Croydon, has been appointed assistant electrical engineer to the Bradford Corporation, at a salary of £250 a year.

Leith.—Mr. W. Relph, of the Stalybridge, Hyde, Mossley and Dukinfield tramways, has been appointed tramway superintendent to the Leith Corporation tramways.

Southampton.—Mr. Street, borough electrical engineer of Southampton, has been recommended for appointment, for a period of twelve months, as manager of the electric tramways of that town. Mr. Street would continue to discharge his present duties while holding the appointment in question. The total salary would be £650 a year.

Manchester.—Mr. S. L. Pearce has been appointed chief electrical engineer at the Manchester electricity works. The appointment is for a period of three years, and the salary is one of £900 for the first year and £1,000 a year for the remainder of the term.

Melbourne.—Mr. E. W. Skeats has been appointed professor of geology at the Melbourne University.

Johannesburg.—Mr. G. H. Stanley, the demonstrator in metallurgy and surveying at the Armstrong College, Newcastle-upon-tyne, has recently received a very important appointment in South Africa, having been elected to the professorship of metallurgy in the Technical Institute, Johannesburg.

Share List of Engineering, Electrical, Iron and Steel, and other Companies.

The following is a comprehensive list of Companies in the industries covered by "Page's Weekly," in which shares business is being currently transacted. Additions will be made from time to time as occasion requires. We desire it to be understood that while our Share List will generally be found correct, we do not hold ourselves responsible for any loss or inconvenience that may arise from possible inaccuracies.

Stock Exchange Settling Days.—Settling days on the Stock Exchange are as follows:—

Consols: March 1st. General Settlements: February 24th, March 15th, 30th. Bank Rate, April 21st, 1904, 3 per cent.

I.—ENGINEERING, IRON, AND STEEL COMPANIES.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
11,270	5	5	Alldays & Onions Pneumatic Engineering, Ltd.	3	2½ — 3
10,000	5	3 -	Do. Cum. Pref. 6 per cent.	5	4½ — 5
3,210,000	1	2 6	Armstrong (Sir W. G.), Whitworth and Co., Ltd.	1	[illegible]
76,970	5	2-	Do. 4% Cum. Pref.	5	[illegible]
1,500,000	100	4	Do. 4% 1st Mort. Dbs. Rd.	100	103 — 105
£100,000	100	4½	Aveling and Porter, Ltd., 4½% Reg Mt Debs. Red. ..	100	96 — 99
530,000	1	1 7½	Babcock and Wilcox, Ltd., Ord ..	1	4½ — [illegible]
100,000	1	7½d.	Do. „ 6%, Cum. Pref.	1	1½ — 1⅝
20,000	5	3 -	Baker (Joseph) and Sons, Ltd., 6% Cum. Pref.	5	5 — [illegible]
250,000	1	6⅝d.	Baldwins, Ltd., 5½% Cum. Pref. ..	1	1 — 1½
£250,000	Stk	4½	Do. 1st Mt. 4½% Deb. Stk. Red.	100	101 — 103
150,000	4½	2 s.	Barrow Hæmatite Steel Co., Ld., O.	4½	[illegible]
50,000	4½	6 -	Do. 4% Cum 2nd. Pref	4½	[illegible]
33,334	5	2,6	Bayliss, Jones and Bayliss, Ltd., 5% Cum. Pref. Shares ..	5	4[illegible] — 5¼
£500,000	100		Beardmore (Wm.) & Co., Ltd., 4½% 1st Mt. Debs., Red., Scrip 50% pd		101 — 103
50,000	10	6 -	Bell Brothers, Ltd., 6% Cum. Pref.	10	11 — 12
£[illegible]	Stk	4	Do 4% Deb. Stock, Red.	100	99 — 101
200,000	1	1 -	Beyer, Peacock and Co., Ltd., Ord.	1	[illegible]
300,000	1	6⅝d.	Do. 5½% Cum Pref.	1	
£300,000	Stk	4½	Do. 4½% Red. Deb. Stock	100	94 — 97
1,629,760	1	6d.	Bolckow, Vaughan and Co., Ltd., O. Nos. 1-1,629,760	1	1 — 1½
1,860,900	1	3d.	Do. Nos. 1,639,101-3,500,000	12/-	[illegible]
1,160,000	1	1½d.	Brown (John) and Co., Lim., Ord., Nos. 1-1,160,000	15/-	1¼ — [illegible]
590,000	1	6d.	Do. Ord., Nos. 1,160,001-1,750,000	1	1 — [illegible]
74,000	10	5	Do. 5% Cum. Pref. ..	10	11¼ — [illegible]
154,500	5	2 6	Cammell, Laird & Co., Ltd., Ord. .	5	[illegible]
232,500	5	2 6	Do. 5% Cum. Pref. ..	5	[illegible]
150,000	1	1 6	Clayton & Shuttleworth, Ltd., Ord.	1	[illegible] — 1
70,000	5	2 6	Do. 5% Cum. Pref.	5	5½ — [illegible]
£[illegible]	Stk	4	Do. 4% 1st Mort. Db. Stk. Red	100	100 — 102
100,000	10	7 6	Consett Iron Co., Ltd., Ord	7½	31½ — [illegible]
[illegible]	10	10 -	Crossley, Bros., Ld., Ord. 40340/97370	10	16¼ — [illegible]
40,339	10	5	Do 5%, Cum. Pref. ..	10	11 — [illegible]
77,000	1	2 6	Delta Metal, Ltd. Shares ..	1	2½ — [illegible]
[illegible]	1	3d.	Dorman, Long & Co., Ltd.	1	[illegible]
£400,000	Stk	4	Do. 4% 1st Mort. Perp. Deb. Stk.	100	91 — 94
200,000	5	3	Dunderland Iron Ore Co., Ltd., 6% Cum. Pref. and Participating ..	[illegible]	[illegible]
[illegible]	1	9d.	Dunlop (James) & Co., Ltd., Ord. ..	1	[illegible]
300,000	1	7½d.	Do. 6% Cum. Pref.	1	[illegible]
4,721	13	12	Ebbw Vale Steel, Iron & Coal Co., Ltd.	13	[illegible]
[illegible]	13	12	Do. do. do.	10	[illegible]
[illegible]	10	8	Elliott's Metal, Ltd.	8	[illegible]
[illegible]	10	[illegible]	Do. Cum. Pref. 5%	10	[illegible]
[illegible]	Stk	4	Do. Deb. 4	100	94½ — 96½
[illegible]	10	6	Fairfield Shipbuilding & Engng. Co., Ltd., 6% Cum. Pref. ..	10	[illegible] — 11
£[illegible]	Stk	4½	Do. 4½% Mort. Deb. Stk. Red.	100	97 — 100
[illegible]	10	10	Fleming & Ferguson, Ltd., Ord. Nos. [illegible]	10	12 — [illegible]
6,000	10	5	Do. Cum. Pref. Nos. [illegible]	10	[illegible] — 10
[illegible]	3	3 -	Fraser & Chalmers, Ltd., Ord.	3	[illegible]
21,000	3	[illegible]	Do. 7½% Cum. Pref.	3	[illegible]
[illegible]	10	[illegible]	Galloways, Ltd., 5% Cum. Pref. [illegible]	10	[illegible]
£[illegible]	Stk	4	Do. 4% 1st Mort. Deb. Red	100	90½ — 91½
[illegible]	10		Greenwood & Batley, Ltd., Ord. ..	10	[illegible]
[illegible]	10	7	Do. 7% Cum. Pref. ..	10	[illegible]
965,000	1	1s	Guest, Keen & Nettlefolds, Ltd. Ord.	1	2 — [illegible]
[illegible]	5	2 6	Do. 5% Cum. Pref.		[illegible]
£1,[illegible]	Stk	4	Do. 4% Irred. Mort. Deb. Stk	100	105 — 107
13,000	[illegible]	2 6	[illegible], Ltd., 5% Cum. Pref.	[illegible]	2 — [illegible]
250,000	1	1	Hadfield's Steel Foundry Co., Ld., Ord	1	[illegible]
20,000	10	1 6	Do. [illegible] Cum. Pref.	10	[illegible]
[illegible]	5	3	Hall (J. & E.), Ltd. 6% Cum. Pref...	[illegible]	[illegible]
[illegible]	1	1 6	Harvey United Steel Co., Ltd. ..	1	1 — [illegible]
47,500	10	7s	Hawthorn, Leslie & Co., Ltd. Ord.	10	11 — [illegible]
28,000	[illegible]	7	Head, Wrightson & Co., Ltd.	[illegible]	[illegible]
[illegible]	1	7d.	Hill (Richard) & Co. (1899) Ld., Ord.	1	[illegible]
18,000	[illegible]	3	Do. 6% Cum. Pref.	[illegible]	[illegible]
30,000	10	6	Hornsby (Richard) & Sons, Ld., Ord.	[illegible]	[illegible]

ENGINEERING, IRON, AND STEEL COMPANIES.—*Cont.*

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
750,000	1	6d.	Howard & Bullough, Ltd., Ord. ..	1	[illegible]
25,000	10	6	Do. 6% Pref. Non Cum.	10	12¼ — 12¾
£250,000	Stk	4	Do. 4% Deb. Stk., Red. after 1905	100	98 — 101
37,500	10	20	Kynoch, Ltd.	10	[illegible] — 19½
[illegible]	10	5	Do. Cum. Pref. 5%	10	10¾ — 11
300,000	1	4d	Lambert Bros., Ltd., Ord.	1	[illegible]
50,000	5	2 9	Do. 5½% Cum. Pref.	5	4 — 4½
40,000	8	2 1	Leeds Forge Co., 7% Cum. Pref. ..	8	[illegible] — 4½
200,000	1	7½d	Lysaght (John), Ltd., 6% Cum. Pf.	1	[illegible]
£300,000	Stk	4½	Do. 4½% 1st Mt. Deb. Stk., Red.	100	108 — 110
40,000	10	5	Mather & Platt, Ld., 5% Cum. Pref.	10	11 — 11½
210,000	1	6d.	Measures Bros., Ltd., Ord. . .	1	[illegible]
75,000	1	6⅝d.	Do. 5½% Cum. Pref.	1	[illegible]
£75,000	Stk	4½	Do. 4½% 1st Mrt. Db. Stk., Red.	100	94 — 97
21,943	5	2 6	Muntz Metal, Ltd.	5	[illegible]
14,248	5	5	Do. Pref. [illegible]	5	5½ — [illegible]
5,000	62½	47 6	Nantyglo and Blaina Iron Works, Ltd., 8% Cum. Pref.	62½	74 — 76
[illegible]	10	5	N. Brit. Loco. Co., Ltd., 5% Cm Pf.	10	[illegible] — 12⅛
[illegible]	5		North-Eastern Steel Co., Ltd., Ord.	5	
£[illegible]	Stk	4½	Do. 4½% 1st Mrt. Db. Stk., Red.	100	90 — 93
[illegible]	5	2	Pearson & Knowles Coal and Iron Co., Ltd., Ord., "B"	5	[illegible] — 4
50,000	5	3 -	Do. 6% Cum. Pref. "A" ..	5	[illegible]
70,000	10	6 -	Pease & Partners, Ltd., Ord. ..	10	10 — 10½
£400,000	Stk	4	Do. 4% Perp. Deb. Stock	100	97 — 100
20,000	5	3	Peebles (Bruce) & Co., Ld., 6% Cm. P.	5	[illegible]
65,000	1		Pooley (Henry) & Son., Ltd., Ord ..	1	5/- — 6/-
13,000	5		Do. 5½% Cum. Pref.	5	[illegible]
230,000	1		Pneumatic C[illegible] 1902, Ltd., Ord.	1	[illegible]
[illegible]	5	2	Rhymney Iron Co., Ltd.	5	[illegible] — 2
[illegible]	5	2	Do. New	5	[illegible]
£330,000		5	Do. 5% Mort. Deb., Red. ..	100	99 — [illegible]
350,000	1	7d	Richardsons, Westgarth & Co., Ltd., 6% Cum. Pf. ..	1	[illegible]
£350,000	Stk	4½	Do. 4½% Perp. Deb. Stock ..	100	94 — [illegible]
35,000	10	1	Ruston, Proctor & Co., Ltd.	10	[illegible]
275,000	1	6d.	Scott (Walter), Ltd., Ord.	1	[illegible] — 1
300,000	1	7d	Do. 6% Cum. Pref. ..	1	1 — 1½
£[illegible]	Stk	4	Do. 4% Perp. Deb. Stk	100	94 — [illegible]
£[illegible]	100		Shelton Iron, Steel and Coal Co., Ld. 1st Charge 5% Debs., Red ..	100	[illegible]
£[illegible]	100	[illegible]	Do. [illegible] 2nd Mort. Debs. Red	100	[illegible]
[illegible]	1	1	[illegible] Steel & Iron, Ltd. [illegible]	1	[illegible]
[illegible]	1	7d	Do. [illegible] Pref.	1	[illegible]
£[illegible]	Stk	[illegible]	Do. 4% Per. Deb. Stock	100	[illegible]
[illegible]	10	[illegible]	Steel C[illegible]	[illegible]	[illegible]
£125,210	Stk	5%	Do. 5% Trust Mort. Deb. ..	100	[illegible]
[illegible]	10		Stephenson (Robert) & Co., Ltd., Or.	10	[illegible]
[illegible]	10	[illegible]	Do. [illegible] Pref.	10	[illegible]
£[illegible]	Stk	4	Do. 4% Perp. Deb. Stock	100	[illegible]
[illegible]	10	1	Stewarts & Lloyds, Ltd., Ord. .	10	[illegible] — 17
[illegible]	10	[illegible]	Do. [illegible] Pref.	10	[illegible]
[illegible]	1	[illegible]	[illegible] Richardson, Lim. Ord.	1	[illegible] — 1
[illegible]	1	[illegible]	Do. 5% Cum. Pref. .. .	1	[illegible] — 1
£240,000	[illegible]	4½	[illegible]	100	98 — 101
300,000	1	[illegible]	[illegible] & Engineering Co., Ltd., 5% Cum. Pf.	1	[illegible]
£[illegible]	100	[illegible]	[illegible]	100	67 — 71
[illegible]	1	[illegible]	[illegible]	1	[illegible] — 1
[illegible]	10		[illegible]	10	[illegible] — 10
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	17 — [illegible]
[illegible]	[illegible]		[illegible]	1	[illegible]
[illegible]	1	[illegible]	[illegible]	1	[illegible]
£750,000	[illegible]		[illegible]	100	114 — 117
£[illegible]	Stk	4	[illegible]	100	[illegible] — 107
£1,000,000	[illegible]	[illegible]	[illegible]	100	[illegible] — 107
[illegible]	[illegible]	[illegible]	[illegible] Ord.	1	[illegible]
500,000	1	7½	Do. 6% Cum. Pref. Ord. ..	1	[illegible]
£300,000	Stk	[illegible]	[illegible]	100	[illegible]
[illegible]	[illegible]		Weldless Steel Tube, Ltd., Cum. Pref.	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	100	[illegible] — 97
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Stk	[illegible]	[illegible] Mort. Deb. Red	100	77 — [illegible]
£150,000	Stk	4½	[illegible], Ltd., [illegible] Mort. Deb. Stk. Red	100	[illegible]

Stocks and Shares marked [illegible]

II.—ELECTRICAL MANUFACTURING COMPANIES.

Present Amount Subscribed	Shares	Last Dividend.	Name	Paid up	Closing Prices.
70,000	1	6d.	Alliance Elec. Co., Ltd. 5% Cum. Pf.	1	⅝ — ⅞
125,000	1	7½d.	Aron Elec. Meter Ltd., 6% Cum. Pf.	1	7/16 — 9/16
120,000	1	9½d.	Bell's Asbestos Co., Ltd.	1	⅝ — ¾
100,000	5	4/-	British Insulated & Helsby Cables Ltd., Ord. ..	5	5¾ — 6¼
100,000	5	3/-	Do. 6% Cum. Pref.	5	5¼ — 5¾
£500,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Rd.	100	101 — 104
£200,000	Stk	4½%	British Thomson-Houston Co., Ltd., 4½% 1st Mort. Deb. Stk. Red. ..	100	101 — 103
400,000	5	3/-	British Westinghouse Electric and Manufac. Co., Ltd., 6%, Pref. ..	5	2½ — 2¾
£616,353	Stk	4%	Do. 4% Mort. Deb. Stk. Red...	100	87 — 89
105,731	2	2/-	Brush Elec. Enging. Co., Ltd., Ord..	2	½ — ¾
150,000	2	2 4½	Do. 6% Pref.	2	1½ — 1¾
£125,000	Stk	4½%	Do. 4½% Perp. 1st Deb. Stk...	100	94 — 97
£125,000	Stk	4½%	Do. 4½% Perp. 2nd Deb. Stk.	100	79 — 82
35,000	5	5/-	Callender's Cable & Constn. Ltd. Ord.	5	10¼ - 10¾
40,000	5	2/6	Do. 5% Cum. Pref.	5	5⅜ - 5⅝
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb Stk. Red.	100	105 — 107
85,000	3	1/6	Crompton & Co., Ltd...	3	2⅛ — 2⅜
£100,000	—	5%	Do. 5% 1st Mort. Reg. Debs.	100	93 — 98
52,000	5	10/-	Dick, Kerr & Co., Ltd., Ord. ..	5	7¾ - 8¼
61,000	5	3/-	Do. 6% Cum. Pref.	5	5⅞ — 6⅛
£300 000	Stk	4½%	Do. 4½% Deb. Stock, Red. ..	100	105 — 107
233,334	1	6d.	Doulton & Co., Ltd., 5% Cum. Pref.	1	1⅛ — 1⅜
£233,334	Stk	4%	Do. 1st Mort. 4% Free. Deb. Stk.	100	105 — 108
99,261	5	1/6	Edison and Swan United Electric Light, Ltd., "A" Shares Nos. 1-99,261	3	⅝ — ⅞
17,139	5	2/6	Do. "A" Shares Nos. 01-017,139	5	1 — 1½
£344,023	Stk	4%	Do. 4% Deb. Stock Red. ..	100	77 — 82
£100,000	Stk	5%	Do. 5% Second Deb. Stk. Red.	100	79 — 84
112,100	2	1 7½	Electric Construction Co., Ltd. ..	2	1⅛ — 1¼
31,390	2	2/9⅜	Do. 7% Cumulative Pref. ..	2	2¼ 2½
£200,000	Stk	4%	Do. 4% Perp. 1st Mt. Deb. Stk.	100	97 — 99
10,248	10	7/6	Evered and Co., Ltd...	10	13 — 15
£100,000	Stk	5%	Ferranti, Ltd., 5% 1st Mort. Deb. Stock, Red...	100	90 — 95
25,000	10	5/-	Gen. Elect. Co. (1900), Ltd., 5% Cum. Pref.	10	9½ — 10
£200,000	Stk	4%	Do. 4% 1st. Mt. Deb. Stk., Red.	100	91 — 96
35,000	5	5/-	Henley's (W. T.) Telegraph Works Co., Ltd., Ord.	5	12 — 12½
35,000	5	2/3	Do. 4½% Cum. Pref... ..	5	5⅜ — 5⅝
£50 000	Stk	4½%	Do. 4½% Mt. Deb. Stk. Red.	100	111 — 113
50,000	10	5/-	India Rubber, Gutta Percha & Telegraph Works Co., Ltd.,	10	15½ — 16½
£300,000	100	4%	Do. 1st Mort. Deb. Red. ..	100	100 — 103
7,500	10		Parker, Thos., Ltd.	10	6½ — 7
100,000	1	3%	Scott (Ernest) & Mountain, Ld., Ord.	1	16/- — 16/6
37,350	12	12/-	Telegraph Construction and Maintenance Co., Ltd.	12	34 — 36
£150,000	100	4%	Do. 4% Deb. Bonds	100	101½ - 103½

III.—ELECTRIC TRACTION.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices.
120,500	5	3/-	Anglo-Argentine Trams Co., Ld., Or.	5	8¼ - 8½
260,007	5	2/6	Do. 5% Cum Pf.	5	5⅝ — 5⅞
£230,000	Stk	6%	Do. Permanent 6% Debenture Stock, 1888 ..	100	140 — 143
20,000	10	6/-	Barcelona Trams Co., Ltd., Ord. ..	10	11¾ 12¼
10,000	10	5/-	Do. 5% Cum Pf. Shares	10	9 — 10
£46,300	100	5%	Do. 5% Debs., Red. ..	100	99 — 102
£191,326	Stk	4½%	Do. 4½% Red. Deb. Stk.	100	96 — 100
75,606	1	—	Bath Elec. Trams. Ld., Pf. Or. ..	1	11/16 13/16
59,394	1	11·49d	Do. 5% Cum. Pf. ..	1	15/16 1 1/16
75,000	5	—	Brisbane Electric Tram Investment Co., Ltd., Ord... ..	5	1¼ - 1½
75,000	5	2/6	Do. 5% Cum. Pf. ..	5	3¾ 4¼
£425,000	Stk	4½%	Do 4½% 1st Deb. Stk., Red.	100	94 — 98
£200,000	Stk	6%	Brit. Columbia Elec. Rly. Co., Ltd., Def. Ord. Stock	100	102 105
		%	Pref. Ord. Stock	100	100 103
133,301	10	6/-	Brit. Electric Traction, Ltd., Ord.	10	9¼ — 9¾
156,427	10	6/-	Do. 6% Cum. Pref... ..	10	11 — 11½*
£1,000,000	Stk	5%	Do. 5% Perp. Deb. Stk. ..	100	120 — 122
£250,000	Stk	4½%	Do. 4% 2nd Deb. Stk. Red..	100	97 99
100,000	5	1/6	Buenos Ayres & Belgrano Electric Trams, Ltd., Ord.	5	3¾ 4
40,500	5	3/-	Do. "A" 6% Cum Pref. ..	5	5⅝ 5⅞
27,000	5	3/-	Do. "B" do.	5	5¼ 5¾

ELECTRIC TRACTION.—*Contd.*

Present Amount Subscribed.	Shares	Last Dividend	Name	Paid up.	Closing Prices
£200,000	Stk	5%	Buenos Ayres Elec. Trams Co. (1901) Ltd., 5% Db. Stk., Red.	100	94 — 97
£220,000	100	6%	Buenos Ayres Gd. Nat., Ltd., 6% 1st Deb. Bds.	100	99 — 102
102,268	5	3/-	Calcutta Tramways Co., Ltd. ..	5	8¾ — 9
£350,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	106 — 108
480,000	1	6d.	Cape Electric Tramways, Ltd. ..	1	1⅜ — 1⅝
40,000	5	2/6	City of Birmingham Trams Co., Ltd. 5% Cum. Pref.	5	4⅞ — 5⅛
£300,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	101 — 104
£120,000	Stk	5%	Colombo Elec. Tram. & Light. Co., Ltd., 5% 1st Mort. Deb. Stk. Red.	100	101 — 104
60,000	10	6/-	Dublin United Trams. Co. (1896), Ltd., Ord. ..	10	13 — 14
59,987	10	6/-	Do. 6% Pref...	10	15½ — 16½
30,000	5	2/6	Isle of Thanet Elec. Trams. and Light. Co., Ltd., 5% Cum. Pref.	5	3¼ — 3¾
£150,000	Stk	4%	Do. 4% Deb. Stock.. ..	100	90 — 93
125,000	10	5/-	London United Trams. (1901), Ltd., 5% Cum. Pref.	10	10⅜ — 10⅝
£1,031,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	103 — 105
£50,000	Stk	5%	Madras Electric Trams (1904), Ltd., 5% Deb. Stock, Red.	100	101 — 103
314,016	1	—	Metropolitan Elec. Trams, Ltd., Def.	1	[illegible]
500,000	1	6d.	Do. 5% Cum. Pref... ..	1	15/16 — 1
£350,000	Stk	4½%	Do. 4½% Deb. Stock, Red.	100	104 — 106
50,000	5	6/-	New General Traction Co., Ltd., 6% Cum. Pref.	5	½ — 1½
110,923	8	2/9½	North Metropolitan Tramways Co..	8	4¼ — 4¾
£150,000	100	3½%	Do. 3½% Mort. Debs.	100	90 — 95
£196,200	Stk	5%	Perth Electric Trams, Ltd. (W.A.) 5% 1st Mort. Deb. Stock, Red..	100	102 — 105
24,500	10	10/-	Potteries Elec. Traction Co., Ld., Or.	10	8 — 9
24,500	10	5/-	Do. 5% Cum. Pref. ..	10	8½ — 9½*
£220 000	Stk	4½%	Do. 4½% Deb. Stk., Red.	100	100 — 103

IV.—ELECTRIC LIGHTING AND POWER.

Present Amount Subscribed	Shares.	Last Dividend.	Name	Paid up.	Closing Prices
7,500	10	16/-	Bournemouth & Poole Elec. Sup. Co., Ltd., Ord. ..	10	12¼ — 12¾
7,500	10	4/6	Do. 4½% Cum. Pref. ..	10	9½ — 10
7,500	10	6/-	Do. 6% Cum. Second Pf. ..	10	11 — 12*
£70,000	Stk	4½%	Do. 4½% Deb. Stock Red ..	100	104 — 106
14,000	5	2/-	Bromley (Kent) Elec. Lt. & Pr. Co. Ld	5	5¼ — 5¾
£50,000	Stk	4½%	Do. do. 4½% 1st Deb. Stk. Red.	100	101 — 104
27,507	5	4/6	Brompton & Kensington Elec. Supply Co., Ltd. Ord. ..	5	10½ — 11
12,493	5	3/6	Do. 7% Cum. Pref. Shares..	5	10¼ — 10¾
60,000	5	3/-	Calcutta Elec. Sup. Cor. Ltd., Ord..	5	9 — 9½
£288,782	Stk	4%	Central Elec. Sup. Co., Ltd., 4% Gua. Deb. Stk. ..	100	105 — 108
70,000	5	4/-	Charing Cross & Strand Elec. Sup. Corp., Ltd., Ord... ..	5	8 — 8½
80,000	5	2/3	Do. do. 4½% Cum. Pref...	5	5½ — 5¾*
£350,000	Stk	4%	Do. do. 4% Deb. Stk. Red.	100	102 — 104
44,436	5	2/3	Chelsea Elec. Sply. Co., Ltd., Ord.	5	6¾ — 7¼
£150,000	Stk	4½%	Do. do. 4½% Deb. Stk., Red	100	108 — 110
70,595	10	5/-	City of London El. Lghtg. Co., Ld., O.	10	12½ 13
40,000	10	6/-	Do. 6% Cum. Pref.	10	13½ — 14
£100,000	Stk	5%	Do. 5% Deb. Stk., Red ..	100	122 — 126
£300,000	Stk	4½%	Do. 4½% 2nd Deb. Stk., Red	100	103 — 105
40,000	10	4/-	County of London Elec. Supply Co., Ltd., Ord.	10	9 — 9½
30,000	10	6/-	Do. 6% Cum. Pref.	10	12 — 12½
£100,000	Stk	4½%	Do. 4½% Deb. Stk., Red. ..	100	108 — 111
70,000	5	2/6	Edmundson's Elec. Cor. Ltd., Ord	5	6¼ - 6¾
70,000	5	3/-	Do. 6% Cum. Pref.	5	6 — 6¼
£300,000	Stk	4½%	Do. 4½% 1st Mort. Db. Stk. Reg	100	106 — 108
£80,000	Stk	5%	Electric Lighting & Traction Co. of Australia, Ltd. 5% Deb. Stk. Red.	100	86 — 91
10,000	5	2/-	Folkestone Elec. Supply Co., Ld., O	5	5½ - 6
£50,000	Stk.	4½%	Do. 4½% 1st Deb. Stk., Red.	100	101 — 104
15,000	10		Havana Electricity Co., Ltd... ..	10	9½ - 10½
13,000	5	3/6	Hove Elec. Lighting Co., Ltd., Ord.	5	7½ - 8
£50,000	Stk	4½%	Isle of Wight Electric Light & Power Co., Ltd. 4½% Deb. Stock, Red.	100	100 - 102
150,000	1	—	Kalgoorlie Electric Power & Lighting Corp, Ltd., 6% Cum. Pref.	1	⅞ 1⅛
21,000	5	5/-	Kensington and Knightsbridge Electric Lighting Co., Ltd., Ord. ..	5	13 13½

Stocks and Shares marked * are quoted ex-dividend.

ELECTRIC LIGHTING AND POWER.—*Contd.*

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
£135,000	Stk	4 %	Kensington and Knightsbridge Electric Lighting Co., Ltd., and the Notting Hill Electric Lighting Co., Ltd., 4% Deb. Stock, Red.	100	102 —104
111,000	3		London Elec. Supply Corp., Ld., Ord.	3	2½ — 2¾
60,000	5	3/-	Do. 6 %, Pref.	5	5¾ — 6
£371,895	Stk	4 %	Do. 4 %, 1st Mort. Db. Stk. Red	100	98 —100
100,000	10	9/-	Metropolitan Elec. Sup. Co., Ld., Or.	10	18½ 19
76,121	5	2/3	Do. 4½ %, Cum. Pref.	5	5½ — 5¾
220,000	Stk	4½ %	Do. 4½% 1st Mort. Db. Sk., Red.	100	110 —115
250,000	Stk	3½ %	Do. 3½ %, Mort. Deb. Stk., Red.	100	96 — 98
£250 000	—	4½ %	Midland Elec. Corp. for Power Distribution Ld., 4½ %, 1st Mort. Deb.	100	97 —100
10,852	10	6/-	Notting Hill Elec. Ltg. Co. Ltd. Ord.	10	14½ 15
£59,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	102 104
16,500	5	2/6	Oxford Electric Co. Ltd., Ord. .	5	6½ - 6¾
£50,000	Stk	4 %	Do. 4 %, Debenture Stk. Red.	100	98 100
£84,700	100	4½%	Royal Elec. Co. (of Montreal) 4½ % 20-yr. 1st Mort. Deb	100	100 102
40,000	5	5/-	St. James' & Pall Mall Elec. Light Co., Ltd. Ord.	5	13¼ -14¼
20,000	5	3/6	Do. 7 %, Pref...	5	8½ — 9
£150,000	Stk	3½ %	Do. 3½ %, Deben. Stock, Red	100	98 —100
12,000	5	4/-	Smithfield Markets Elec. Supply Co., Ltd. Ord.	5	2¾ — 3¼
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	79 - 83
65,000	5	3/-	South London Elec. Sup. Co., Ltd. O.	5	4½ — 4¾
100,000	1		South Metropolitan Elec Light & Power Co., Ltd. Ord.	1	¾ — 1
50,000	1	8½d.	Do. 7 %, Cum. Pref.	1	1⅛ - 1$\frac{3}{16}$
£100,000	Stk	4½%	Do. 4½% 1st Deb. Stock Red.	100	107 —110
50,000	5	2/6	Urban Electric Supply Co., Ltd., O.	5	5 — 5½
30,000	5	2/6	Do. 5 %, Cum Pref. .. .	5	5½ — 5¾
£200,000	Stk		Do. 4½ %, 1st Mort. Deb Stk. Red	100	105 —107
110,000	5	6/6	Westminster Elec. Supply Corp. Ltd., Ord.	5	13¼ — 13¾
28,151	5	2/6	Do. 5 %, Cum. Pref.	5	6½ - 6¾

V.—TELEGRAPH & TELEPHONE COMPANIES.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
£34,800	100	4 %	African Direct Tel. Co., Ld., 4% Mt. Debs. (Series A), Red.	100	99 102
25,000	10	—	Amazon Telegraph Co., Ld. . ..	10	1½ — 2
£763,580	Stk	17/6	Anglo-American Tel. Co., Ltd., Ord.	100	59 — 61
£3,118,210	Stk	35/-	Do. 6% Preferred Ordinary	100	105 107
£3,118,210	Stk	2/-	Do. Deferred Ordinary ..	100	13½ 14
14,000	5	3/-	Chili Telephone Co., Ltd.	5	6½ 6¾
$15,000,000	$100	$2	Commercial Cable Co., Capital Stk.	$100	170 190
£1,903,876	Stk	4 %	Do. Sterl. 500-yr 4% Deb. Stk., Red.	100	96 — 98
16,000	10	7/-	Cuba Submarine Tel. Co., Ld., Ord.	10	8¼ — 9¼
6,000	10	10/-	Do. 10% Preference	10	17 18
6,000	5	2/-	Direct Spanish Telegraph Co., Ord.	5	3½ 3¾
		5/-	10% Cum. Preference	5	8 — 8½
£30,000	50	4½ %	Do. 4½ Debs.	50	100-102%
60,710	20	4/-	Direct U.S. Cable Co., Ltd. . ..	20	11 —11½
£85,800	100	4½ %	Direct West India Cable Co., Ltd., 4½ % Reg. Debs.	100	99 101
£300,000	100	4 %	East. & S. African, Ld., 4% Mt. Dbs.	100	100 102
£300 000	25	4 %	Do. 4 %, Rg. Mt. Dbs. (Mauritius Subsidy)	25	101-103%
300 000	10	2/6	Eastern Extension, Australasia and China, Ltd...	10	13¾— 14¼
£602 100	Stk	4 %	Do. 4% Mort. Deb. Stk., Perp.	100	104 —106
£4,000,000	Stk	25/-	Eastern Tele. Co., Ltd., Ord. ..	100	140 —143
£2,000,000	Stk	17/6	Do. 3½ %, Pref. ..	100	88 — 90
£1,836,814	Stk	4 %	Do. 4% Mort. Deb.	100	105 108
150,000	10	5/-	Great Northern Telegraph Co., Ltd., (of Copenhagen) ..	10	30 — 30½
£58 700	100	4½ %	Halifax and Bermudas Cable Co., Ltd., 4½% 1st. Mort. Debs. Red.	100	100 102
17,000	25	12/6	Indo European Tele. Co., Ltd	25	46 48
72,680	1	7½d.	Monte Video Telephone Co., Ltd., O.	1	½ [illegible]
£1,983,333	Stk	6 %	National Telephone Co., Ltd., Pref.	100	109½ — 110½
£1,966 667	Stk	5 %	Do. Deferred ..	100	104 —106
250,000	5	2/6	Do. 5 %, Non Cum. 3rd Pref.	5	7½ — 8
£2,000,000	Stk	3½ %	Do. 3½ %, Deb. Stk., Red.	100	94 — 99
£689,393	Stk	4 %	Do. 4 %, do. do.	100	102 104
179,313	1	7½d.	Oriental Telephone & Elec. Co., Ltd	1	1⅛ — 1¼
50,000	1	7½d.	Do. 6 %, Cum. Pref	1	1 — 1⅛
£100,000	100	4 %	Pacific & European Tel. 4 % Guar. Debs. Red...	100	98 101
11,839	8	4/-	Reuter's Telegram Co., Ltd.	8	7½ — 7¾
58,000	5	3/-	United River Plate Teleph. Co., Ltd.	5	7½ 7¾
40,000	5	2/6	Do. 5 %, Cum. Pref	5	[illegible] [illegible]
£179,917	Stk	5 %	Do. 5%, Deb. Stock, Red. ..	100	105 —108
15,609	10	4/-	W. African Telegraph Co., Ltd. ..	10	7½ 7¾
£30,008	2½		West Coast of America, Ltd.	2½	[illegible]
150,000	100	4 %	Do. 4 %, Deb. Guar. by West Tel	100	99 — 102

TELEGRAPHS AND TELEPHONES.—*Contd.*

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
88,321	10	6d.	W. India & Panama Teleg. Co., Ld., Or.	10	1 — 1½
34,563	10	6/-	Do. 6 % Cum. 1st. Pref. .	10	7¼ 8¼
4,669	10	6/-	Do. 6 % Cum. 2nd Pref. ..	10	7¼ 7¾
£80,000	100	5 %	Do. 5 % Deb. . ..	100	102 104
207,930	10	3/-	Western Telegraph Co., Ltd. ..	10	13½ — 14
£75,000	100	5%	Do. 5% Debs., 2nd Series, 1906	100	101 —103
518,915	Stk	4%	Do. 4% Deb. Stock, Red. ..	100	102 —104

VI.—SHIPPING COMPANIES.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
32,500	10	5/6	Anchor Line (Henderson Bros.), Ltd., 5½% Cum. Pref.	10	8½ — 9
£325,000	Stk	4½ %	Do. 4½% Red. 1st Mort. Deb. Stk.	100	99 101
£672,900	Stk	4½ %	British & African Stm. Nav. (1900), Ltd., 4½ %, 1st Mort. Deb. Stk. Red.	100	93 - 95
40,000	10	5/6	Bucknall Steamship Lines, Ltd., 5½% Cum. Pref.	10	6 — 6½
£600,000	Stk	4 %	Do. 4 % 1st Mort. Deb. Stk.	100	74 — 77
£750,000	Stk	4½ %	Clan Line Steamers, Ltd., 4½% Deb. Stk. Red. ..	100	98 —100
60 000	20	16/-	Cunard Steam Ship Co., Ltd., Nos. 1-60,000..	20	13¾ - 14¼
40,000	20	8/-	Do. Nos. 60,001-100,000	10	6 — 6½
£450,430	Stk	4½ %	Elder Dempster Shipping, Ltd., 4½% 1st Mort. Deb. Stk. ..	100	101 —103
1,200,000	1	6d.	Furness, Withy & Co., Ltd., Ord...	1	1 — 1$\frac{3}{16}$
25,328	7½	4/7	Gen. Steam Navigation Co., Ld., Ord.	7½	4¼ - 4¾
36,758	8	4/9	Do. Non-Cum. 6% Pref.	8	7½ — 8
£150,000	Stk	4 %	Do. 4% 1st Mort. Deb. Stk. Red.	100	97 — 99
55,000	5	1/3	Houlder Line, Ltd., Ord.	5	2½ — 3
40,000	5	2/9	Do. 5½% Cum. Pref.	5	3¼ 3¾
£200 000	Stk	4½ %	Do. 4½% 1st Mt. Deb. Stk. Red.	100	83 86
141,500	10	5/-	Leyland (Fredk.), & Co. (1900), Ltd., 5% Cum. Pref. ..	10	4¾ - 5¼
£1,160,000	Stk	5 %	Peninsular and Oriental Steam Nav. Co., 5% Cum. Pref. ..	100	129 —132
£1,160,000	Stk	19 %	Do. do. Deferred .	100	222 —225
15,000	100	30/-	Royal Mail Steam Packet Co. Ord..	60	25½ - 26½
39,075	5	2/6	Shaw, Savill & Albion, Ltd., 5% Cum. "A" Pref..	5	4¾ — 5¼
39,075	5	2/6	Do. "B" Ord... . ..	5	4 — 4½
141,841	10	4/-	Union Castle Mail Steamship Co., Ltd., Ord..	10	8¼ — 8¾
21,000	10	4/6	Do. 4½ % Cum. Pref. . .	10	9¾ 10¼
£1,008,894	Stk	4 %	Do. 4% Debenture Stk., Red.	100	99 —101

VII.—MISCELLANEOUS COMPANIES.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
60 000	1	9d.	Chadburn's Ship Tele. Ltd., Ord.	1	¾ — 1⅛
£750,000	Stk	5 %	General Hydraulic Power Co., Ltd.	100	109 — 111
12,000	10	10/-	Oakey (John) and Sons, Ltd., Ord	10	24 — 26
10,000	10	6/-	Do. do. 6 % Cum Pf	10	14 15
183,538	1	6·3d.	Power Gas Corp., Ltd., Ord., Nos. 66,463-250	15/-	[illegible] [illegible]
66,462	1	8·4d.	Do. do. Nos. 1-66,462	1	[illegible] [illegible]
135,000	1	6d	Waygood (R.) & Co., Ltd., Ord. ..	1	1 — 1$\frac{1}{16}$
15 000	1	7½d.	Do. 6 % Cum. Pref.	1	1⅛ — 1¼

RAILWAY CARRIAGE & WAGON COMPANIES.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
10,800	[illegible]	7/-	[illegible] Carr. & Wagon, L., 1-10,000	20	21½ 22½
[illegible]	10	[illegible]	Do. [illegible]	4	8½ 9
10 000	20	6/-	Do. Cum. Pref. 6%, 1-10,000..	10	13 13½
[illegible]	7	7/-	[illegible] Carr. & Wagon, Ltd., [illegible]	7	9 9½
11 [illegible]	7	[illegible]	Do. [illegible]	7	4 4½
[illegible]	[illegible]	[illegible]	[illegible] Ord.	2	2 2½
[illegible]	[illegible]	[illegible]	Do. do.	10	10½ 10½
784,808	1	[illegible]	Metropolitan Amalgamated Rail. Carriage & Wagon Ltd., 1-784,808	1	12/- 12/6
161,288	1	[illegible]	Do. [illegible] 1-161,288	1	21/6 21/6
235,000	1	[illegible]	Do. [illegible] 1-235,000	1	28/- 28/6
20,000	10	[illegible]	Midland Rail. Carr. & Wagon, Ltd., 1-20,000	10	14 15½

Stocks and Shares marked [illegible]

THE HOME METAL MARKET.

SHOWING DAILY FLUCTUATIONS FROM JANUARY 23RD TO FEBRUARY 21ST, 1905.

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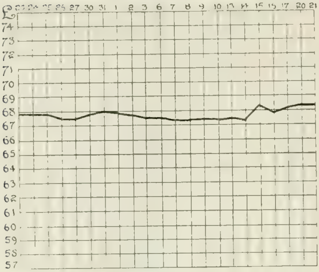

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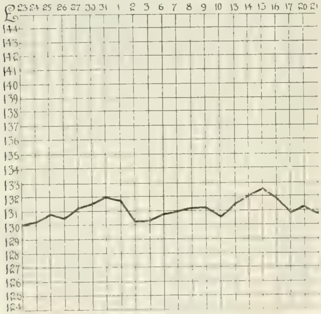

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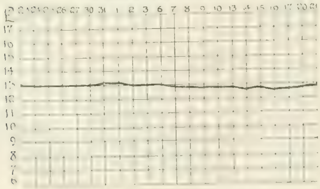
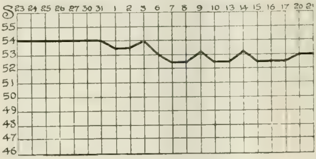


PIG IRON: SCOTCH,



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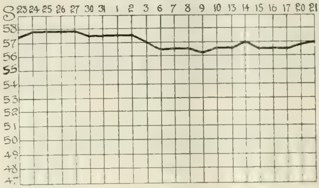
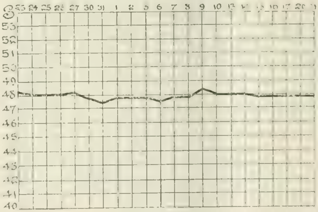
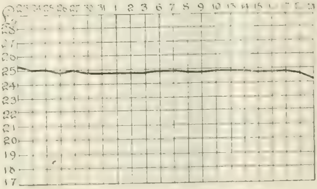


CLEVELAND.



SPELTER.



PRICES CURRENT OF COAL, IRON, STEEL, AND OTHER METALS.

MANUFACTURERS' AND MERCHANTS' QUOTATIONS.

MARKET REPORT.

Wednesday, February 22nd, 1905.

THE higher prices for copper, which it was suggested in this column last week would be seen in the immediate future, are already with us. Indeed there has been a tendency to push quotations up too rapidly, the first signs of speculative buying causing a rise from £67 15s. for three months' standard to £68 15s. The quotation remains at about this level, but an early resumption of the buying movement is suggested by trading requirements, and copper ought then to touch a higher level.

Tin shows rather more activity on the revival in copper, and at one time as high as £132 10s. had to be bid for near delivery. A sharp relapse followed, but on more encouraging advices from the East the tone is now firmer. The bear arguments in a circular emanating from an American source, which was scattered broadcast last week, should not be regarded too seriously. The predictions of large additions to supplies appear to be based on misconception. The closing price fine foreign, cash, is £131 5s.

Large arrivals of Lead have caused a sharp fall in quotations, holders preferring to make sacrificing sales in preference to warehousing the metal.

Spelter is steady but business has been restricted. The settlement of the Silesian strike has relieved consumers of the fear of a dwindling supply.

In the Iron and Steel section a large speculative business is being done on the iron market, but looking to the large character of transactions, movements in prices have been of a comparatively unimportant character. Middlesbrough stocks continue to increase, the figures now standing at 260,359 tons against 250,506 tons a week ago. There is very little fresh to report on the general trade position. The advices from America are good and provincial correspondents write hopefully of the outlook, although at the present moment an easier tendency is noticeable.

The Timber trade shows signs of revival, but the higher prices which are being asked by shippers in view of the shipbuilding boom are rather previous.

Coal is a small market, steams are quiet and the Welsh market generally is inactive.

IRON, STEEL, PIG-IRON, &c.

SCOTLAND.

Messrs. David Colville and Sons, Ltd., Dalzell Steel and Iron Works, Motherwell, N.B., quote as follows. Prices delivered in Glasgow or equal :—

	£	s.	d.
Steel :			
Siemens' Steel Plates, Marine Boiler Quality	6	15	0
" " " Land " "	6	17	6
" " " Ship Quality Plates	5	17	6
Siemens' Steel Bars, Boiler Quality	6	17	6
" " " Ship "	6	7	6
" " Angles	5	7	6
Manufactured Iron :			
Bars—Dalzell	6	2	6
" Best	6	12	6
" " Horseshoe	6	12	6
" Angle	6	2	6
" Best Angle	6	12	6
" Best Best	7	2	6
" Extra Best	7	12	6

Usual terms and extras. Special rates for delivery in England and export. The above prices subject to alteration without notice.

The Glasgow Iron and Steel Co., Ltd., Wishaw, quote as under (prices are delivered Glasgow or equal) :

	£	s.	d.	
Steel Angles (Glasgow ♔ Steel)	5	7	6	per ton.
Steel Ship Plates (Glasgow ♔ Steel)	5	17	6	"
Steel Bars, Ship Quality (Glasgow ♔ Steel)	6	7	6	"
Steel Bars, Boiler Quality (Glasgow ♚ ♚ Steel)	6	17	6	"
Steel Land Boiler Plates (Glasgow ♚ ♚ Steel)	6	7	6	"
Steel Marine Boiler Plates (Glasgow ♚ ♚ Steel)	6	7	6	"

Less 5 per cent. discount. Extras as per standard list.

Special prices for delivery in England and for export. The above prices subject to alteration without notice.

John Spencer (Coatbridge), Ltd., Phœnix Ironworks, Coatbridge, N.B., quotes :—

	£	s.	d.
Bars—Phœnix	6	5	0
Best	6	15	0
Best best	7	5	0
Extra Best	7	15	0
Best Horse Shoe	6	15	0
Extra B H S	7	15	0
Extra Best Crown	8	5	0
Rivet	6	5	0
Best Snap Rivet	7	5	0

	£	s.	d.
Angles—Phœnix	6	5	0
,, Best	6	15	0
,, Extra Best	7	5	0
Gas Tube Hoops—Phœnix Best	6	15	0
Plates—Phœnix	—		
,, Best Boiler	7	10	0
,, Best Best Boiler	8	0	0
,, Extra Best Boiler	9	0	0
Boiler Tube Strips—Phœnix Best Best	8	0	0

All per ton, delivered f.a.s., Glasgow, Greenock, Grangemouth, Granton, Leith, or Ardrossan. 5 per cent. discount cash monthly.

Messrs. R. Feldtmann and Co., of Glasgow, quote Commission extra).

Pig Iron:	No. 1. £	s.	d.	No. 3. £	s.	d.
Coltness, f.a.s. Glasgow	3	4	6	2	14	0
Gartsherrie ,,	2	19	0	2	14	0
Summerlee ,,	2	19	0	2	14	0
Carnbroe ,,	2	16	6	2	12	6
Langloan ,,	3	4	0	2	15	0
Calder ,,	2	19	0	2	13	6
Clyde ,,	2	18	6	2	13	6
Glengarnock, f.o.b. Ardrossan	2	18	6	2	12	6
Eglinton ,, ,,	2	14	6	2	12	6
Dalmellington, ,, Ayr	2	14	6	2	12	6
Shotts ,, Leith	2	19	0	2	14	6

NORTH OF ENGLAND.

Messrs. W. Whitwell and Co., Ltd., Thornaby Ironworks, Stockton, quote as follows, **at works**:—

	£	s.	d.
W.W. Bars	6	12	6
W.W. Best Bars	7	2	6
W.W. Best Best	7	12	6
W.W. Best Best Best	8	2	6
W.W. Best Shoe	7	2	6
Thornaby	8	2	6
Thornaby Best	8	12	6
Thornaby Best Best	9	12	6
Whitwell Special Admiralty Cable	10	5	0
Special Chain Iron	9	5	0
Tube and Nail Strips	6	15	0
W.W. Angle Iron	6	15	0
W.W. Best Angle Iron	7	5	0
Tee Iron, to 8-inches United	7	12	6

Terms, Cash, less 2½ per cent. discount on 10th of month following delivery.

LANCASHIRE.

The Pearson and Knowles Coal and Iron Company, Ltd. Dallam and Bewsey Forges, Warrington, quote :—

	Iron. £	s.	d.	Steel £	s.	d.
(BF) Bars	6	10	0	7	5	0
,, Angles	7	0	0	7	5	0
,, ,, Tees	7	10	0	7	15	0
WIW Hoops	7	0	0	7	10	0
,, ,, Sheets	7	10	0	8	0	0

Ordinary Sizes, F.A.S. Liverpool in 10-ton Lots.
Extras for Sizes and Cutting as per List.

WORCESTERSHIRE.

Baldwins Ltd. (with which is amalgamated Knight and Crowther, Ltd.), Wilden Works, near Stourport, quote :—

Black Sheets:	Singles 20 G 96in. by 36in. per ton. £	s.	d.	Doubles 21 G to 24 G 96in. by 36in. per ton. £	s.	d.
"Vale"	10	0	0	10	10	0
"Shield"	10	10	0	11	10	0
"Severn"	11	10	0	12	10	0
"Baldwin Wilden B."	12	10	0	13	10	0
Charcoal	16	10	0	17	10	0
Best Charcoal	18	10	0	19	10	0

Pickled, cold-rolled and close annealed sheets specially quoted for.

Extra widths, Singles to 66in., Doubles to 56in., Lattens to 46in. Extra lengths, Singles to 168in., Doubles to 132in., Lattens to 108in.

Patent Coated Sheets:	£	s.	d.	£	s.	d.
No. 3 Lead	13	10	0	14	10	0
S.V. Lead	15	0	0	16	0	0
No. 3 Terne	15	0	0	16	0	0
S.V. Terne	16	10	0	17	10	0

Tinned Sheets:	Singles 20 G to 108 by 36in. per ton. £	s.	d.	Doubles 21 to 24 G to 96 by 36in. per ton. £	s.	d.
Best Coke (Finish)	28	0	0	29	10	0
,, Charcoal (Finish)	30	0	0	31	10	0
Extra ,, ,,	32	0	0	33	10	0

Cotton Can Tin Sheets to 39in. by 36in. specially quoted for.

Tin Plates, "Cookley, K" Best Charcoal, £1 7s. 0d. per box.

Extreme sizes in Tin and Patent Coated specially quoted for.

Lattens up to 36 wide by 27 W.G. £1 10s. 0d. per ton extra throughout for all brands.

At works less 2½% for cash monthly, 10th inst.

Galvanized Corrugated Sheets:

	£	s.	d.	
"Phœnix" Brand, 24 G., f.o.b. London, in Bundles	11	15	0	per ton.
"Blackwall" Brand, 26 G., in felt-lined cases for Australia, f.o.b. London	14	7	6	,,

Galvanized Working Up-Sheets:

	£	s.	d.	
24 G., f.o.b. London, in Bundles	13	15	0	per ton.

STAFFORDSHIRE.

Shelton Iron, Steel, and Coal Co., Ltd., Stoke-on-Trent, North Staffordshire, and 122, Cannon Street, London, quote :—

	£	s.	d.	
Crown Bars	6	10	0	per ton.
Best Bars (1 to 6in. wide, above ¼ in. thick, ½ in. to 4 rounds and squares)	7	0	0	,,
Angles	6	15	0	,,
,, Best	7	5	0	,,
Tees	7	0	0	,,
,, Best	7	10	0	,,
Best Shoe Iron	8	0	0	,,
,, Rivet Iron	8	0	0	,,
,, Best Rivet (Special)	9	5	0	,,
,, Cable	9	5	0	,,
,, Screwing	8	5	0	,,

	£	s.	d.	
Best Turning	8	0	0	per ton.
,, Plating	8	5	0	,,
,, ,, Best Best	9	5	0	,,
,, ,, Treble	10	5	0	,,
Plates	7	10	0	,,
Best Plates	8	0	0	,,
,, Boiler Plates	8	10	0	,,
,, Best Boiler Plates	9	10	0	,,
Treble Best Boiler Plates	12	0	0	,,

Delivery f.o.b. Liverpool, Birkenhead or Manchester.

WALES.

Cordes (Dos Works), Ltd., of Newport, Mon., quote "Star" brand patent wrought nails, steel nails, &c.

Discounts—

45 per cent. off 1-inch to 3-inch strong rose and all fine rose and 6dy. and 8dy. pound.

40 per cent. off 3½ inch to 7-inch strong rose and 10dy. and 20dy. pound.

40 per cent. off all sharp-pointed nails.

Delivered in lots of 4 cwt. and upwards. Extra 2½ per cent. discount off the gross on two tons and upwards.

Steel rose, flat points, 5-inch to 7-inch basis :—

2 tons 9/6 per cwt.
4 cwt. lots and upwards 9/9 per cwt. } d/d any Railway Station.

Steel cut nails, 3-inch basis—

2 tons 8/3 per cwt.
4 cwt. lots 8/6 per cwt. } d/d any Railway Station.

Slit rods (iron) £7 10s. per ton, at works for 2-ton lots.

Messrs. Richard Thomas and Co., Ltd., of 33 and 35, Eastcheap, E. C. — Works: South Wales, Burry, Lydney, Lydbrook, and Cwmbwrla, quote:

	Per Box. f.o.b. Wales. £	s.	d.
Coke Tin-plates.			
C 18¼ by 14 124s. 110 lb. "BV"	0	12	9
C 20 by 10 225s. 155 ,, "Jumbo"	0	17	9
C 20 by 14 112s. 108 ,, "Lydbrook"	0	12	3
C 28 by 20 112s. 216 ,, "Lydbrook"	1	4	9
Charcoal Tinplates:			
C 20 by 14 112s. 108 lb. "Allaway"	0	13	0

BELGIUM.

C. L. Faulkner, Suffolk House, Laurence Pountney Hill, London, E.C., quotes :—

Prices quoted are in £ stg. and per ton of 1,015 kos. (2,240 lb.) delivered free on board ANTWERP for approved quantities.

		£	s.	d	
Steel:					
Blooms	at	3	12	0	per ton.
Billet	at	3	14	0	,,
Sheet Bars	at	3	16	0	,,
Finished Steel:					
Bars	at	5	0	0	per ton.
Angle	at	5	1	0	,,
Tees	at	5	4	0	,,
Joists	at	4	10	0	,,
Fencing Standards	at	5	2	0	,,
Shoeing Bars	at	5	4	0	,,
Tyre Bars	at	5	4	0	,,
Half Round Bars	at	5	5	0	,,
Heavy Rails	at	4	15	0	,,
Light Rails	at	4	17	6	,,

Structural Steelwork:

Prices on application.

METALS.

Messrs. French and Smith, 147, Leadenhall Street, and 11, Oldhall Street, Liverpool, quote :—

TIN.

Tin:	£	s.	d.		£	s.	d.	
English Ingots, f.o.b. Dis. 1½%, & 1%	131	10	0	to	132	0	0	per ton.
English Bars, f.o.b. Dis. 1½%, & 1	132	10	0	to	133	0	0	,,
Straits G.M.B., cash Warehouse, Net	130	17	6	to	131	0	0	,,
Straits G.M.B., 3 months, Warehouse, Net	130	2	6	to	130	5	0	,,
Australian, Mr. Bischoff, Warehouse, Net	131	10	0	to	131	15	0	,,

COPPER.

Copper:	£	s.	d.		£	s.	d	
Standard G.M.B., cash Warehouse, Net	68	2	6	to	68	3	9	per ton.
Standard G.M.B., 3 months, Warehouse, Net	68	10	0	to	68	11	3	,,
English, Tough, Cake & Ingot, Warehouses, Net	70	10	0	to	71	0	0	,,
English, Best Select, Warehouse Net	71	0	0	to	72	0	0	,,
English, Sheets and Sheathing, f.o.b., Dis. 2½%	80	0	0	to	80	10	0	,,
English, Sheets for India, f.o.b., Dis. 2½%	76	0	0	to	76	10	0	,,
Electro, Warehouse, Net	70	15	0	to	71	0	0	,,
Ore, ex. ship	0	12	0	to	0	13	0	per unit
Regulus, Matte and Precipitate, ex. ship.	0	13	3	to	0	14	0	,,

YELLOW METAL.

Yellow Metal:	£	s.	d.	£	s.	d.	
Sheets, 4 by 4 feet for India f.o.b. Dis. 2½%				0	0	6¾	per lb.
Sheathing ,, ,,				0	0	6⅞	,,

SPELTER.

	£	s.	d.		£	s.	d.	
Silesian outports, Net	24	15	0	to	25	0	0	per ton.
Blende of 50 % Net	6	16	6	to	7	0	0	,,
Calamine, Net	6	19	0	to	7	0	0	,,

LEAD.

	£	s.	d.		£	s.	d.	
English Pig, Warehouse, Dis. 2½	12	15	0	to	12	17	6	per ton.
Spanish, ex ship, Dis. 2½	12	8	9	to	12	10	0	,,
Lead Ore of 70 %, Net	6	4	6	to				,,

ANTIMONY.

	£	s.	d.		£	s.	d.	
Star Regulus, f.o.b. Dis. 2½	35	10	0	to	36	0	0	per ton.
Ore, 50 %, ex ship, Dis. 2½	8	10	0	to	9	10	0	,,
Crude ex ship, Dis. 2½	13	10	0	to	14	0	0	,,

QUICKSILVER.

	£	s.	d.	
Spanish, 75 lb. Warehouse, Net	7	12	6	per flask
Italian	7	11	6	,,

COAL.

LEICESTERSHIRE.

The Nailstone Colliery Company, Leicester, quote. Price per Ton at Pit of 20 Cwt., with ½ Cwt. per Ton for wastage —

Upper Main Seam.	s.	d.
Main Coal	7	6
Best Hard Steam (hand picked, as used by the Railway Companies)	6	0
Best Hard Steam Cobbles (made through 6 in. mesh, free from slack)	6	0
Fine Slack	0	6

Terms, net cash on 10th of month following delivery.

DERBYSHIRE.

The Manners Colliery Co., Ltd., of Ilkeston quote as follows, per ton at pit:

Kilburn Coal:	s.	d.
Best London Brights	9	9
Large Nuts (1½ to 3¼)	9	6
Small Nuts (¾ to 1½)	6	0
Rough Brights	6	0
Peas (⅜ to ¾)	5	0
Slack	3	6
Smudge	2	0

Low Main (or Tupton) Coal:		
Low Main Brights	7	6
,, ,, Nuts	7	3
Hards (Good Steam Coal)	8	0
Bakers' Nuts (1" to 2")	6	6
Slack	3	6

The Clay Cross Company's Collieries, Clay Cross, near Chesterfield, quote:—

	per ton at pit. s.	 d.
Best Main Coal	10	6
Best Silkstone	10	0
Best House Coal	8	6
Best House Nuts	8	0
Treble Screened Cobbles	7	9
Best Cobbles	7	3

NOTTINGHAMSHIRE.

The Digby Colliery Co., Ltd., near Nottingham, quote per ton at pit :—

Digby Coal:

STEAM.	s.	d.
Best Hand Picked Hard	9	0
Steam Hard	7	9
Hard Nuts	7	0

Gedling Colliery.

HIGH HAZEL.	s.	d.
London Brights, 4 to 8 in. cube	12	0
Large Nuts, 2 to 4 in. cube	9	6
Small Nuts, ¾ to 2 in. cube	5	6
STEAM TOP HARD		
Best Hard	9	0
Hard Steam	8	0
Cobbles	7	0

CHEMICALS AND OILS.

CHEMICALS.

Messrs. S. W. Royse and Co., Albert Square, Manchester, quote:

		£	s.	d.	
Acids:	Oxalic	0	0	2⅛	per lb.
	Picric, Crystals	0	0	11	,,
	Tartaric .... at Manchester	0	0	10⅞	,,

		£	s.	d.	
Acetate of Lime:	Brown at Manchester net	9	10	0	per ton.
	Grey ,, —	11	10	0	,,
Alumina:	Alum, Lump, loose	5	5	0	,,
	,, ,, in casks	5	7	6	,,
	,, Ground, in bags	5	15	0	,,
	Sulphate of Alumina, 14%	4	10	0	,,
Ammonia:	Carbonate	0	0	3⅝	per lb.
	Muriate Grey f.o.b. Liverpool	24	0	0	per ton.
	Sal-ammoniac, Lump, 1sts, del^d. U.K.	42	0	0	,,
	,, ,, 2nds, ,,	40	0	0	,,
	Sulphate .... f.o b. Liverpool	13	5	0	,,
Arsenic:	Best White Powdered ....net	12	5	0	,,
Bleaching Powder,	35% .... ,,	4	10	0	,,
Borax:	British Refined Crystal........ ,,	12	0	0	,,

Coal Tar Products:		£	s.	d.	
Benzole, 50/90 %	,,	0	0	8¾	per gal.
,, 90%	,,	0	0	10	,,
Carbolic Acid Crystals, 34/35° C. ...	,,	0	0	6⅞	per lb.
,, ,, ,, 39/40° C. ...	,,	0	0	7⅛	,,
,, ,, Liquid, 97/99 % ...	,,	0	0	9	per gal.
,, ,, Crude, 62½% at 60° F. f.o.b.	,,	0	2	0	,,
Creosote, ordinary good liquid......	,,	0	0	1¼	,,
Naphtha, Crude, 20 % at 120° C....	,,	0	0	3	,,
,, Solvent. 90% at 160° C. f.o.b	,,	0	0	8½	,,
,, ,, 95 % at 160° C. ,,	,,	0	0	9½	,,
,, ,, 90 % at 190° C. ,,	,,	0	0	10½	,,
,, Rectified, flash point over 73° F. ....f.o.b.	,,	0	0	11	,,
,, Rectified, flash point over 100° F. ....f.o.b.	,,		1	0	,,
Naphthalene, all qualities.					
Pitch...............f.a.s. Manchester.	,,	1	11	6	per ton.
Copperas: Green, in bulk	,,	0	12	6	,,
,, barrels f.o.b. L'pool	,,	1	19	0	,,
Cake	,,	1	2	6	,,
Copper: Sulphate		22	15	0	,,
Cyanides: 98% minimum ......f o.b.	net	0	0	8	per lb.

		£	s.	d.	
Lead:	Acetate (Sugar) White, English......	27	10	0	per ton.
	,, ,, ,, Foreign c.i.f. U.K	24	5	0	,,
	,, ,, Grey	21	15	0	,,
	,, ,, Brown at Manchester	17	0	0	,,
	Nitrate	24	0	0	,,
	Litharge, Flake	15	10	0	,,
	,, Powder	16	0	0	,,
	Red Lead, Genuine, c.i.f. London less 5%	15	10	0	,,
	White ,, ,, Dry ,, ,, ,,	16	15	0	,,
Naphtha (Wood):	Miscible, 60 o.p.	0	2	10	per gal.
	Solvent	0	2	7	,,
Potash:	Bichromate... delivered England...	0	0	3	per lb.
	Carbonate, 90/92 % ... c.i.f Hull ...	18	0	0	per ton.
	Caustic, 75/80 % ...... ,, ,, ...	20	10	0	,,
	Chlorate ....net	0	0	$3\frac{1}{16}$	per lb.
	Montreal ... in Store, Liverpool	35	0	0	per ton.
	Prussiate, Yellow ....net	0	0	5	per lb.

	£	s.	d.	
Soda: Ash, Caustic, 48 %, Ordinary .. net	5	5	0	per ton.
,, ,, ,, Refined... ..	6	5	0	,,
,, Carbonated, 48 %............ ,,	5	10	0	,,
,, ,, 58 %, (Ammonia Alkali) ... . net	4	10	0	,,
,, Bleachers' Refined Caustic 50/52 % .... net	6	10	0	,,
Caustic, White, 77 %........ ..... ,,	10	10	0	,,
,, ,, 70 % .... ,,	9	12	6	,,
,, ,, 60 % .... ,,	8	12	6	,,
,, Cream, 60 %..... .... ,,	8	10	0	,,
Crystals, in bags	3	0	0	,,
,, barrels	3	7	6	,,
Acetate .... c.i.f. Hull net	16	10	0	,,
Bicarbonate, in 1 cwt. kegs..........	6	15	0	,,
Bichromate......delivered England...	0	0	2¼	per lb.
Chlorate .... net	0	0	$3\frac{1}{16}$	per lb.
Nitrate . ex quay Liverpool.	11	7	6	per ton.
Phosphate	9	5	0	,,
Prussiate ....net	0	0	3⅝	per lb.
Silicate, Solution, 140° Tw.	4	10	0	per ton.
Sulphate (Glauber Salts)..............	1	12	6	,,
,, (Saltcake, 95%)..............	1	15	0	,,
Sulphur: Recovered	4	15	0	,,
Roll	6	15	0	,,
Flowers	7	10	0	,,
Zinc: Sulphate	6	15	0	,,

MINERALS.

	£	s.	d.	
Barytes: Lump Carbonate, 90/92%, ...	3	10	0	per ton.
Sulphate, No. 1, White	2	15	0	,,
China Clay: of various qualities for all purposes; prices from about 11/- to about 30/- per ton, f.o.b. Cornwall: stocks also kept at Runcorn and Preston. Quotations given carriage paid.				
Chrome Ore: Basis 50% c.i.f. British Ports.......................	3	7	6	,,
Manganese: Lump c.i.f. Liverpool 10¼d.	per metallic unit.			
Ochre: French JC ..... f.o.b. Rouen, net	2	5	0	per ton.
,, JF	5	10	0	,,
Talc: (French Chalk).........c.i.f. Liverpool	3	10	0	,,

OILS, etc.

	£	s.	d	
Aniline Oil ....net	0	0	4¾	per lb.
,, **Salt**.......... .... ,,	0	0	4½	,,
Castor Oil: French, 1st pressure, f.o.b. Marseilles less 1½%.........	23	0	0	per ton.
English, 1st pressure, f.o.r. Hull, less 2½%, ...	23	10	0	,,
Cocoa Nut Oil: Ceylon, ex store Manchester .... net	29	10	0	,,
Cochin, ex store Manchester ... ... net	32	0	0	,,
Cotton Seed Oil: Refined at Hull, less 2½%, naked	13	10	0	,,
Edible...at Hull, less 2½% naked	14	0	0	,,
Glycerine: Crude, 80% .... net	31	0	0	,,
Linseed Oil: Raw... ..at Hull, less 2½% naked	13	12	6	,,
Boiled......at Hull less 2½% naked	14	12	6	,,
Starch: American Pearl.. at Manchester, net	9	0	0	,,
Dextrine... ,, ,,	18	0	0	,,
Farina .... ,, ,,	15	15	0	,,
Shellac: Standard TN orange spot	140/-			per cwt.
Turpentine: American .. at Liverpool	38	10	0	per ton
Russian ....at Hull...net	19	0		,,

TIMBER.

Messrs. Alfred Dobell and Co., Liverpool, quote:—

COLONIAL WOODS.

Timber.

		£	s.	d.		£	s.	d.
Quebec Square White Pine...	per cub. ft.	0	1	9	to	0	3	0
Quebec Waney Board Pine...	,,	0	2	8		0	3	9
St. John Pine, 18 in. average	,,	0	2	4		0	3	3
Lower Ports Pine..............	,,	0	1	3		0	1	8
Quebec Red Pine	,,	0	1	6		0	2	0
Quebec Oak, 1st quality	,,	0	2	9		0	3	4
Quebec Oak, 2nd quality ...	,,	0	1	6		0	2	6
Ash	,,	0	1	6		0	2	3
Elm	,,	0	3	3		0	3	10
Hickory	,,	0	2	0		0	2	6
Quebec Birch	,,	0	1	6		0	2	3
St. John Birch ...	,,	0	1	6		0	2	0
Birch Planks....................	,,	0	0	9		0	0	11
Spruce Spars	,,	0	0	10		0	1	0

Deals.

		£	s.	d.		£	s.	d.
1st quality Quebec Pine ...	per std.	22	10	0	to	32	10	0
2nd do. do. ...	,,	17	0	0		22	0	0
3rd do. do ...	,,	11	10	0		13	0	0
St. John, N.B., etc., Spruce	,,	6	15	0		7	5	0
Lower Ports Spruce	,,	6	10	0		6	15	0
Spruce Boards................	,,	5	10	0		6	0	0

UNITED STATES, etc., WOODS.

Pitch Pine.

		£	s.	d		£	s.	d.
Hewn	per cub. ft.	0	1	4	to	0	1	8
Sawn	,,	0	0	11		0	1	6
Planks, Stowage	,,	0	0	10		0	1	0
Boards, Prime	per std.	12	10	0		16	0	0
Oak Timber	per cub. ft.	0	1	6		0	2	6
Oak Planks	,,	0	1	6		0	2	1
East India Teak..............	per load	12	0	0		16	0	0
Greenheart..........................	,,	6	15	0		7	10	0

EUROPEAN WOODS.

Timber.

		£	s.	d.		£	s.	d.
Riga Redwood	per cub. ft.	0	1	6	to	0	2	0
Dantzic and Memel Fir, Crown	,,	0	2	1		0	2	6
Dantzic and Memel Fir, Middling	,,	0	1	9		0	1	11
Stettin	,,	0	1	9		0	1	11
Swedish	,,	0	1	0		0	1	3
Riga Whitewood	,,	0	1	0		0	1	3
Norway Mining Timber ...	,,	0	0	9		0	1	0
Dantzic and Stettin, etc., Oak	,,	0	2	6		0	3	0
Norway Spars.............	,,	0	1	2		0	1	9

Deals.

		£	s.	d.		£	s.	d.
Red Archangel and Onega, 1st quality ...	per std.	19	0	0		20	0	0
Red Archangel and Onega, 2nd quality	,,	14	0	0		16	0	0
Red Archangel and Onega, 3rd quality ...	,,	10	10	0		12	10	0
St. Petersburg, 1st quality...	,,	16	0	0		17	10	0
Do. 2nd ...	,,	14	0	0		15	0	0
Gefle	,,	11	10	0		16	0	0
Wyburg	,,	11	0	0		12	10	0
Uleaborg ...	,,	10	0	0		12	10	0
Gothenburg ...	,,	11	0	0		16	0	0

SELECTED PATENTS.

Compiled expressly for this journal by **Messrs. Page and Rowlingson, Engineering Patent Agents, 28, New Bridge Street, London, E.C.,** and at Manchester.

Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton Buildings, Chancery Lane, W.C., at the uniform price of 8d.

NEW PATENTS APPLIED FOR.

When Patents have been communicated the names of the communicators are printed in italics.

2270. E. K. Ansorge, Kingston-on-Thames. Feb. 6th. An improved ratchet wrench.

2275. R. C. Livesey, Manchester. Feb. 6th.—Improvements in warping machines.

2282. J. Meikle, London. Feb. 6th.—Self-indicating automatic lubricator.

2290. W. H. A. Robertson, Birmingham. Feb. 6th.—An improved tubular boiler for motor carriages, wagons, and other suitable purposes.

2293. A. Jack, Renfrewshire. Feb. 6th.—Reversing and controlling rotation in internal combustion engines.

2312. L. W. Hancock, London. Feb. 6th.—Improvements in wrenches.

2314. M. F. Christensen, London. Feb. 6th.—Machine for making rounded bodies.

2318. A. G. Taylor, London. Feb. 6th.—An improved adjustable spanner.

2329. A. J. Boult, London. Feb 6th.—Improvements in or relating to rotary engines (*M. B. Mills, U.S.A.*).

2340. J. Hussey, London. Feb. 6th.—Improvements in float valves, and draw-off and other cocks and taps.

2356. F. W. Flint and C. M. Gates, London. Feb. 6th.—Improvements in steam turbines or rotary engines.

2366. R. H. Rice, London. Feb. 6th.—Improvements in governing mechanisms for elastic fluid turbines. (Date applied for, Feb. 6th, 1904.)

2388. R. C. Pessell and R. Ord, Birmingham. Feb, 7th.—Improvements in the mode of and means for governing the speed of oil engines.

2400. H. E, Francis, London. Feb. 7th.—Diving torpedo-boat.

2408. A. E. Shute, Glasgow. Feb. 7th.—Improvements in vertical boilers.

2411. J. H. Gault, London. Feb. 7th.—Method of producing seamless hollow metallic vessels.

2415. F. G. Heath, Birmingham. Feb. 7th.—A new or improved swivel joint.

2431. D. Black and W. W. Black, London. Feb. 7th.—Improvements in drills or bits for drilling holes in rock and the like.

2437. W. H. Couling, Devon. Feb. 7th.—An improved method of variable speed gearing for machinery.

2439. L. D. Lovekin, London. Feb. 7th.—Improvements in machines for expanding and flanging metal pipe.

2442. E. A. Munn, London. Feb. 7th.—Improvements in gate or valve mechanism for grain hoppers, chutes and the like. (Date applied for May 21st, 1904.)

2459. P. Redford, Manchester. Feb. 7th.—Improvements in metallic packings.

2476. N. Lombard, London. Feb. 7th.—Improvements in governors.

2478. G. H. Truxell and L. M. Burget, London. Feb. 7th.—Improvements in concrete wall forming machines.

2486. L. Nussbaum, London.—Device for automatically securing miners' trucks in their cage.

2487. E. Peckham, London. Feb. 7th.—Improvements relating to axle journal boxes.

2489. E. Peckham, London. Feb. 7th.—Improvements in axle lubricators.

2500. J. L. Rushton, Manchester. Feb. 8th.—Improvements in bearings for rotating shafts, particularly for the tin roller shafts of spinning and like machines.

2516. A. Hitchon, E. Hitchon, J. R. Hitchon and Hitchon Gear and Automobile Company, Ltd., Accrington. Feb. 8th.—Improved induction valve for internal combustion engines.

2522. C. J. Montgomery, and W. Prescott, Liverpool. Feb. 8th.—Improvements in means for locking nuts in any required position on a bolt stud or other screw.

2525. D. Deas, and A. Deas, Glasgow. Feb. 8th.—Improvements in rotary engines.

2533. J. E. Schmidt, Kidderminster. Feb. 8th.—An electric high and low water level indicator for water tube boilers.

2538. A. Robertson, London. Feb. 8th.—Auxiliary tools for turning lathes.

2548. B. Mitchell, London. Feb. 8th.—Improvements in steam boilers.

2550. W. Badger, Junr., London. Feb. 8th.—Improvements in and relating to sprocket wheels.

2568. R. F. Yorke, Stirling. Feb. 8th.—Improvements in steam generators.

2571. F. E. Smith, and C. T. Russell, London. Feb. 8th.—Improvements in slide valve mechanisms for steam engines.

2614. R. H. Wood, Southport. Feb. 9th. A patent guard for turning lathes.

2618. J. Riley, Stockton-on-Tees. Feb. 9th.—An improved water-tube vertical boiler.

2620. W. Baldwin, Blackburn. Feb. 9th.—Improvements in or relating to stop valves for steam or other purposes.

2625. A. Lefebvre, Manchester. Feb. 9th.—Pneumatic tools or devices for grinding or polishing valves on their seats and for other purposes.

2630. H. Begg, Junr., London. Feb. 9th.—Improvements in angle iron and other metallic bars.

2636. A. W. Lawder, and M. N. Ridley, London. Feb. 9th.—Improvements in or relating to ventilating valves, sluice traps, or other similar apparatus.

2650. W. H Heeson, London. Feb. 9th.—Improvements in the construction of boiler furnaces.

2657. J. Smith, Surrey. Feb. 9th.—Improvements in and relating to the superheating of steam or steam engines.

2667. J. F. Jones, London. Feb. 9th.—Improvements in spanners, wrenches, pipe-grips, and the like.

2745. The Taynge Tool and Electric Co., Ltd., and C. Pendlebury, London. Feb. 10th.—Improvements in change gearing for lathes and other machine tools, motor-cars, and machinery in general.

2754. F. E. Jordan, London. Feb. 10th.—Improvements in superheaters for smoke prevention and improving combustion, as applied to steam boilers, furnaces, and the like.

2755. T. W. Hill, London. Feb. 10th.—Improvements in and relating to belts for the transmission of power.

2758. T. E. Clarke, London. Feb. 10th.—Automatic coupling.

2781. F. P. Hummel, London. Feb. 10th.—Improvements in instantaneous steam generators.

2795. G. Mitchell, London. Feb. 10th.—Improvements in apparatus for generating steam from hot slag.

2796. D. Morell, London. Feb. 10th.—Improvements in and connected with packing discs for rotary engines.

2799. O. Briede, London. Feb. 10th.—Improvements in or relating to Pilger rolling mills.

2825. W. G. Crossthwaite, Leeds. Feb. 11th.—Improvements in or relating to furnaces.

2827. H. J. Brashier, London. Feb. 11th.—Improvements in or relating to ball or float valves for water cisterns or other purposes.

2843. T. Bamforth and A. Robertson, London. Feb 11th.—Improvements in machines for moulding ships' side-lights or scuttles.

2847. J. Watts, Cheshire. Feb. 11th.—Improvements in clay excavators for digging clay automatically.

2851. Fried. Krupp Aktiengesellschaft, London. Feb. 11th. Improvements in and means for cooling crank pins and shafts. (Date applied for March 10th, 1904.)

2861. A. J. Boult, London. Feb. 11th.—Improvements in or relating to the treatment of lead and like ores. (*La Société Anonyme des Mines de Bormettes and Alfredo Lotti France.*)

2876. A. Chambolle, London. Feb. 11.—Improvements in cocks for water gas and other mains. (Date applied for April 9th 1904

RECENT SPECIFICATIONS.

LIQUID FUEL BURNERS.

Sir W. G. Armstrong, Whitworth and Co., Ltd., E. L. Orde, and W. H. Sodeau, of Newcastle-on-Tyne. Feb. 8th 1904.—The object of this invention is to effect improvements in burners for petroleum or other liquid fuel, whereby such burners may be adapted to secure, when necessary, the smokeless combustion of the largest possible quantity of liquid fuel in a given cubic space or furnace and this is accomplished by such a disposition and proportioning of the various parts of the burner as to bring about the intimate admixture of an appropriate amount of air with sprayed petroleum or other liquid fuel, before it leaves the outlet of the burner and becomes ignited, and in giving to the issuing flame such velocity of outflow as prevents it from lighting back within the burner and enables it to traverse the furnace space in spite of any cross currents of air supplied for the purpose of completing combustion, to the outside of the flame. The apparatus employed consists of a mixing tube placed entirely or mainly outside the furnace space and arranged so as to provide in the form of an induced current a quantity of air equal to not less than about four times the weight of oil in the spray for mixing with the oil spray prior to ignition, the said mixing tube being shaped so as to confine the air and the spray and proportioned so as to secure the intimate admixture of the two before ignition, such proportioning involving the continuation of the mixing tube to a point considerably beyond the suction plate.

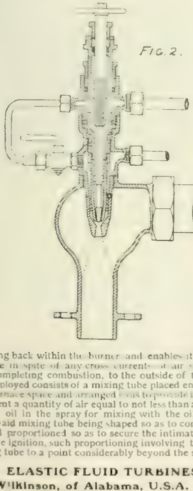
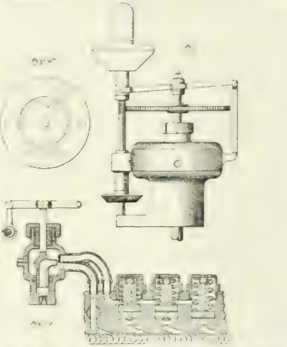


FIG. 2.

ELASTIC FLUID TURBINES.

James Wilkinson, of Alabama, U.S.A. Jan. 4th 1904. (Date claimed under the International Convention).—The invention relates to an improved governing mechanism for elastic fluid turbines wherein a number of motor fluid valves are controlled and successively actuated by a body of fluid subjected to pressure created by impact and regulated in a controller passage by the injector action of a stream of fluid under the control of a governor-shifted nozzle, the position of which relatively to said passage determines the potential of the static pressure therein. To produce a constant speed of rotation under varying loads by this governing mechanism an intermittent rising and lowering of the pressure of the controller fluid is provided sufficient to pulsate the valve or valves nearest the critical point of regulation in order to compensate variations in load between stated points of economy represented by the several nozzles and of a value corresponding to their horse-power capacity. If there be no wire drawing action of the turbine valves it is not possible to the governing devices now in use when the nozzles are of fixed proportions to maintain a constant speed of shaft rotation, since they will have no movement whose controlling effect is capable of compensating variations in load between the stated points of economy under its control. By intermittently opening the valve at the critical point of regulation for intervals of varying duration as load variations intermediate of the points of economy may be compensated. This is effected by rotating the controller nozzle or oscillating it, so that the impact pressure of the fluid stream in the controller passage will be effected.



PUMPS.

C. Day and W. A. Dexter, of the Mirrlees-Watson Co., Ltd., of Glasgow. Dec 15th, 1904.—This invention relates to pumps working in connection with steam condensers of either surface or jet type and used for extracting water from the condensers, and it more especially applies where the air and water are extracted from the condenser by separate pumps. The object is to secure a more efficient extraction of the water from the condenser. To attain this object it is proposed to control the admittance of the water to the pump by a mechanically operated slide valve or valves; the discharge of the water from the pumps may be controlled by the same valve as controls the suction, or by an ordinary valve opened by the pressure of the water. In this invention it is arranged that the valve which controls the entrance of the water to the pump is mechanically opened, thus securing an uninterrupted passage of water from the condenser to the pump throughout each suction stroke of the pump, thus giving a minimum of resistance to the entrance of the water to the pump, and a maximum voluntary displacement the valve being arranged to open immediately on commencement of the suction stroke and close immediately on the completion of the stroke so that no water slips back past the valve and the full quantity is discharged through the discharge ports; this discharge port may be controlled either by the same valve or by any other type of valve desired.

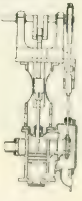


FIG. 1.

FIG. 2.

NEW PUBLICATIONS.

"BRITISH PROGRESS IN MUNICIPAL ENGINEERING."

A series of Three Lectures by William H. Maxwell, A.M.Inst.C.E. (Volume I. of the National Engineering and Trade Lectures. Edited by Ben. H. Morgan.) Archibald Constable and Co., Ltd. 6s. net.

The primary object of this scheme of lectures is to show colonial and foreign buyers what progress Great Britain has made up to the present time in the manufacture of all classes of machinery and goods. The present volume deals with a subject of vital importance to the general community, for, as Mr. Maxwell remarks, municipal progress is largely coincident with the social progress of the people and the developments of science. The work opens with a succinct account of the rapid succession of advances which have built up the present-day programme of municipal engineering practice ; the writer then thoroughly discusses the principles of road engineering and maintenance, a lecture which is accompanied by a number of sectional drawings showing constructional details ; particulars are given of the machinery utilised in roadway construction, including steam road rollers, road surface scarifiers, stonebreakers and roadedge paring plant. The second lecture is devoted to sewerage and main drainage, sewage disposal and the disposal of domestic and trade refuse ; special attention is given to the bacterial purification of sewage and the disposal of refuse by fire. Probably the most important section of the book is that dealing with water supply. The writer details the various schemes planned by the leading municipalities, and indicates the great progress made in the design and economy of pumping machinery in this branch of engineering activity. Following each section is a classified list of British manufacturers interested in the particular sphere of industry covered by the preceding lecture. Those anxious to make a special study of this subject will find the list of municipal engineering literature given in the appendix of considerable service.

"THE UNIVERSAL ELECTRICAL DIRECTORY, 1905."

Containing a complete record of all the industries directly or indirectly connected with electricity and magnetism. H. Alabaster, Gatehouse and Co. 14s.

This invaluable compilation has now reached its twenty-fourth year of publication ; among many other important features it contains the names and addresses of members of the electrical and allied trades and professions throughout the world. The directory is divided into four sections: British, Colonial, U.S.A., and Continental ; each of these sections is again divided into alphabetical and classified divisions, and in the case of the British, a geographical section is also included. We have submitted the volume to a number of severe tests, each time with satisfactory results. The work of revision has been thoroughly carried out, and all the information contained in the volume appears to have been brought up to date.

BOOKS RECEIVED.

Mechanical Appliances, Mechanical Movements and Novelties of Construction. By Gardner D. Hiscox, M.E. Second Series. Archibald Constable. 12s. 6d. net.

The Elements of Railway Economics. By W. M. Acworth. Clarendon Press. 2s. net.

The Oil Mill's Directory, 1905-6. Second Edition. Simpkin Marshall Hamilton Kent and Co., Ltd. 2s. 6d. net.

Engineering Drawing and Design. By S. H. Wells. Part I Practical Geometry. Part II Machine Drawing. 4s. 6d. each.

NEW CATALOGUES.

Messrs. J. Parkinson and Son, of Canal Ironworks, Shipley, Yorkshire, have issued an attractive little booklet entitled "About Vises." This is arranged in the form of short paragraphs, points of special interest being rendered in heavy black lettering, while the cross heads are printed in red. Several illustrations and two pages for memoranda are included.

The subject of List No. 70 (January, 1905) issued by Messrs. Holden and Brooke, Ltd., of Sirius Works, West Gorton, Manchester, is Brooke's Patent Injectors, of which many illustrations and diagrams are included. Some useful information is given on "How to select the right size of Injector," together with a number of tables.

From Messrs. Boot and Son, Ltd., Printers and Stationers, of 32, Fleet Street, E.C., we have received an illustrated calendar for February, a copy of Boot's Memo. Tablet, and a circular dealing with "Slit Leaf" Duplicate Post-Card Books, which appear to be a valuable business auxiliary.

Messrs. J. S. Fairfax and Co., of 37 and 39, Essex Street, Strand, W.C., forward their List No. 1. (Direct Driving from High Speed Shafts at Low Speeds) of Fairfax's Patents. Reduction and Speed varying Gear, for driving direct from armature or engine shafts at standard ratios. Variable Speed Pulley Shafts. Compound Bearings for Reducing or increasing Speed. Hoisting and Winding Gear. Each different type is described and illustrated with the aid of tables and line drawings.

Messrs. W. T. Glover, and Co., Ltd., of Manchester, send a price list of rubber cables with discount sheet. The catalogue last issued remains in force without alteration of prices in any way, for diatrine paper lead covered cables, diatrine paper "leadless" cables and Bitumen cables. Details are given of the new "Non Association" cables, which are referred to elsewhere in this issue.

From The Begbie Manufacturing Company, of 407, Oxford Street, W., we have received an illustrated catalogue and price list of "Aster" engines, gears and coils ; Longuemare Carburetters ; Begbie-Audin Radiators ; back and front axles ; pumps ; lubricators ; Chassis ; Begbie-Lamplough steering gears ; Begbie Oleo sparking plugs, etc.

"**Mechanical Ventilation Specialities**" is the title of Messrs. John Gibbs and Son's new catalogue, which we note cancels all previous issues. It describes and illustrates the firm's improved patent air propelling and ventilating fans.

The "Gus" Gas and Gasoline Engines are illustrated and described in a pamphlet issued by the manufacturers, The Carl Anderson Company, of 23-27, North Clinton-street, Chicago, U.S.A., of which firm Mr. Eric S. A. Smith is English representative. We have also received leaflets illustrating the "Dandy" back-geared pumping jack, and the improved "Oriole" compressed tablet machine.

MEETINGS FOR THE ENSUING WEEK.

FRIDAY, FEB. 24.—Institution of Civil Engineers, Great George Street, S.W. : Student's Meeting, 8 p.m.—Institution of Electrical Engineers (Manchester Local Section) : 7.30 p.m., Paper "Metallography," Mr. Buttenshaw.—Manchester Motor Show Opens. Edinburgh Motor Show Opens. Royal Society, 9 p.m. : Paper, "Fungi," Professor H. Marshall Ward.—Physical Society. Electro-Harmonic Smoker, Holborn Restaurant, Ladies' Night.—Rugby Engineering Society 8 p.m. : Lecture, "The Minute Structure of Metals," Mr. J. T. Milton.

SATURDAY, FEB. 25.—Royal Institution, 3 p.m.—Manchester Association of Engineers, 7 p.m. : Paper, "Pig Irons and their use in Foundry and Forge," Mr. E. Adamson.

MONDAY, FEB. 27.—Institute of Marine Engineers, Stratford, 8 p.m.—Association of Technical Institutions : Annual General Meeting, School of Technology, Manchester.—Society of Arts : Cantor Lecture, "Internal Combustion Engines," Mr. Dugald Clerk.—Institution of Electrical Engineers (Newcastle Local Section).

TUESDAY, FEB. 28.—Society of Arts (Colonial Section).—The University of Liverpool Engineering Society, 5.30 p.m. : Paper, "The Mechanics of a Plant Skeleton," Professor R. J. Harvey Gibson.—Royal Institution, 5 p.m.

WEDNESDAY, MAR. 1.—Society of Arts. Ordinary Meeting, "British Art Section of St. Louis Exhibition," Mr. Isidore Spielmann.

THURSDAY, MAR. 2.—Chemical Society, 8 p.m.—Dundee Institution of Engineers : Paper, "The Motor Car of To-day," Mr. A. Morris Thomson.—Royal Institution : Paper, "Recent Astronomical Progress," Professor H. H. Turner.—Royal Society, 4.30 p.m. Institution of Civil and Mechanical Engineers, 8 p.m.

FRIDAY, MAR. 3.—Royal Society, 9 p.m. : Lecture, Mr. G. Marconi "Recent Advances in Wireless Telegraphy." Liverpool Motor Show opens.

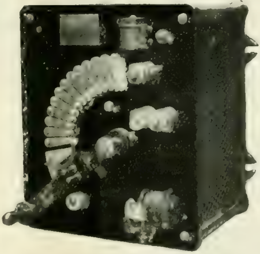
PAGE'S WEEKLY Miscellaneous

"IGRANIC"

Patented

MEANS

PROGRESS IN RHEOSTATS



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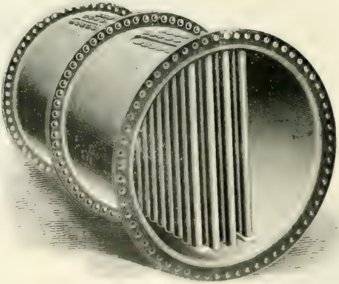
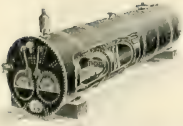


[illegible] PREMIER TUBES



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PAGE'S WEEKLY Engines

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Engines and Generator

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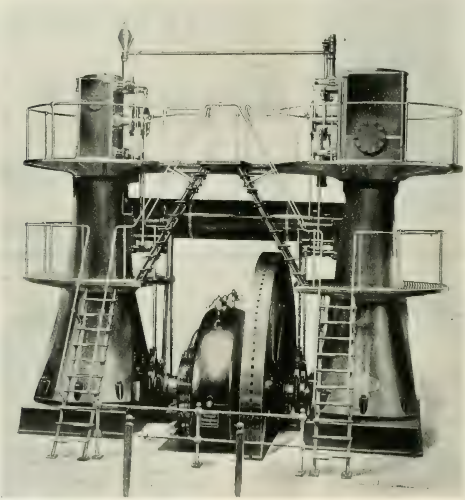

The Engine cost £2,450. The Generator cost £1,300.

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H.P. Cylinder diameter	**18** in	Main Bearings, length	**24** in.
L.P. " "	**36** in.	Piston rod, diameter	**3½** in.
Stroke of Cylinders	**42** in.	Crosshead Pin, diameter and length	**6½** in. by **6½** in.
Steam Inlet, diameter	**6** in	Crank Pin, diameter and length	**7** in. by **7** in.
Exhaust Outlet, diameter	**13** in.	Bore of Crosshead Guide	**24** in
Main Bearings, diameter	**14** in		

GENERATOR.—300 kw Direct Current, Shunt Wound, Engine Type Westinghouse Generator, **500** volts, **8** poles, at **90** revolutions per minute or will do **265** kw at **440** volts at **90** revolutions per minute.

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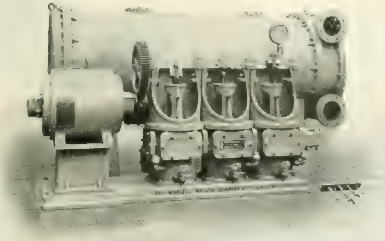

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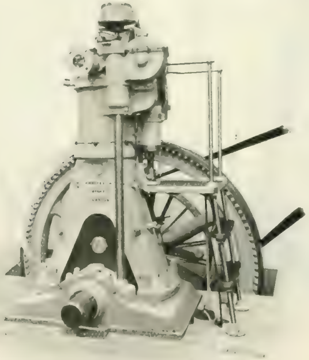

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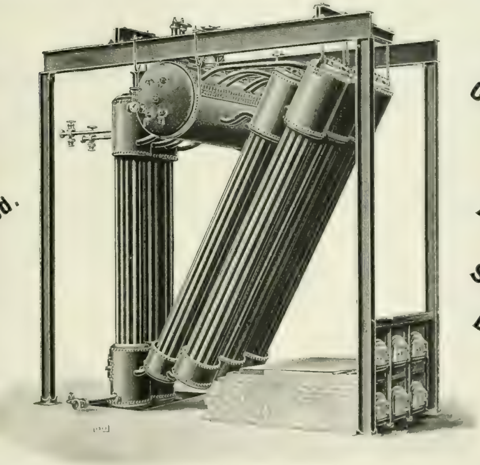

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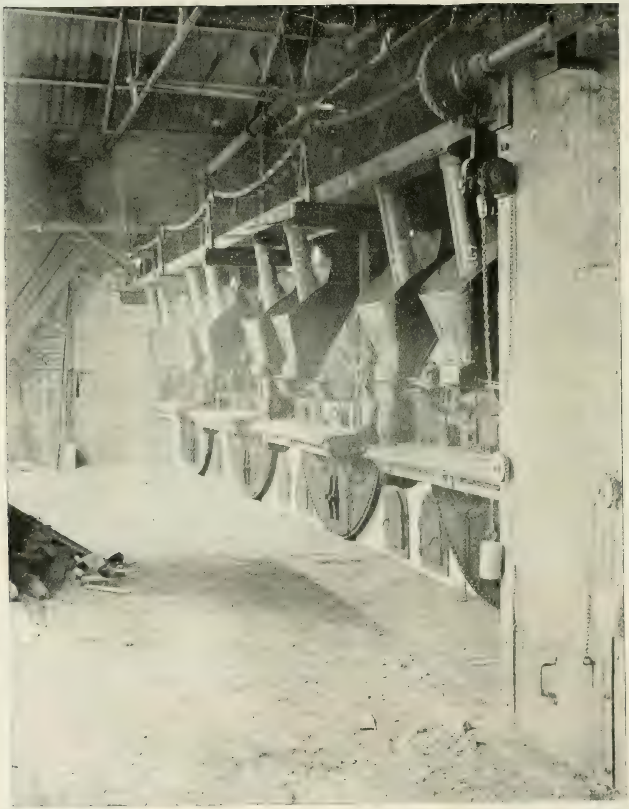

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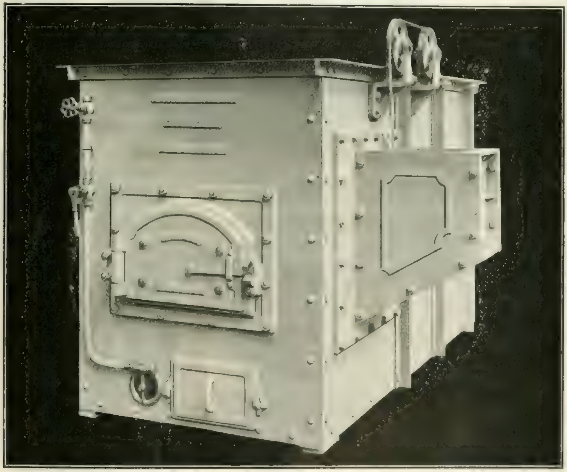

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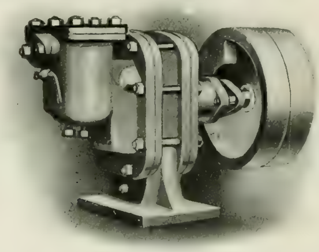

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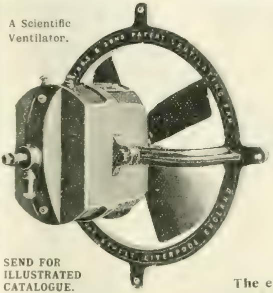

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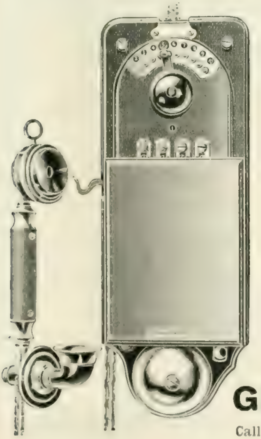

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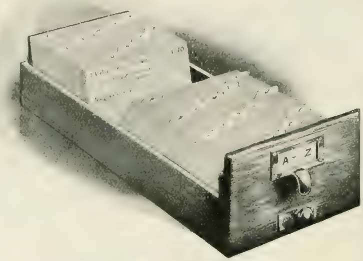

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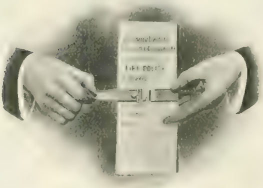

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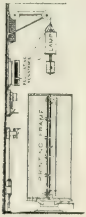

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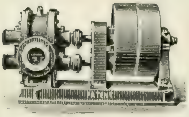

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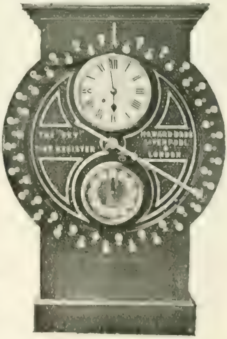

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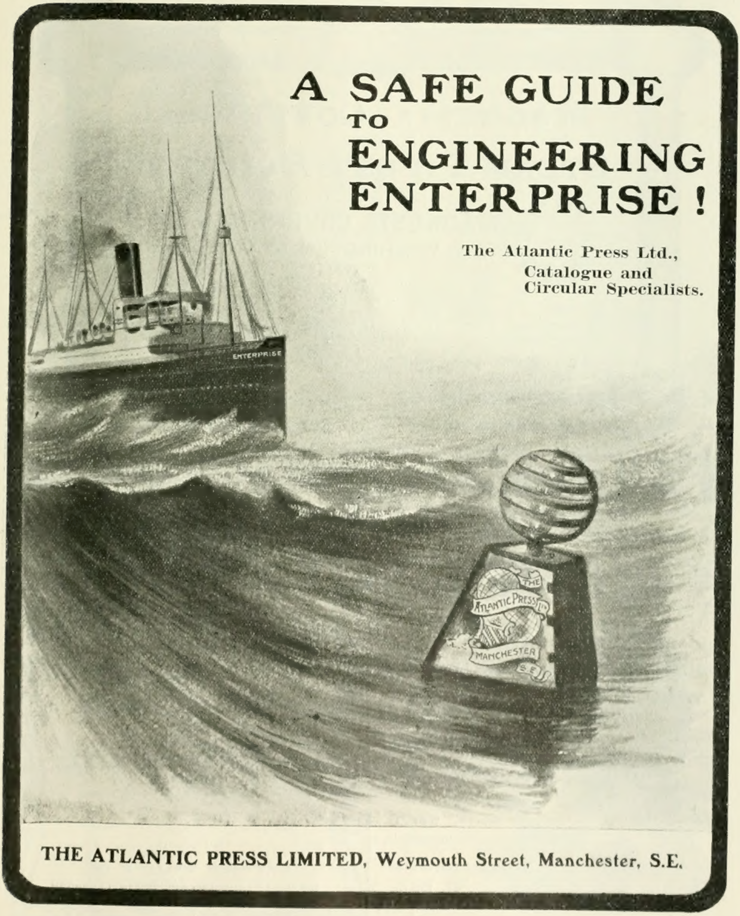

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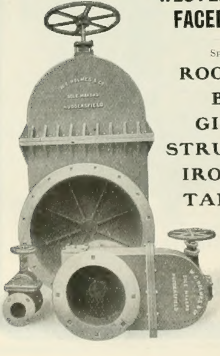

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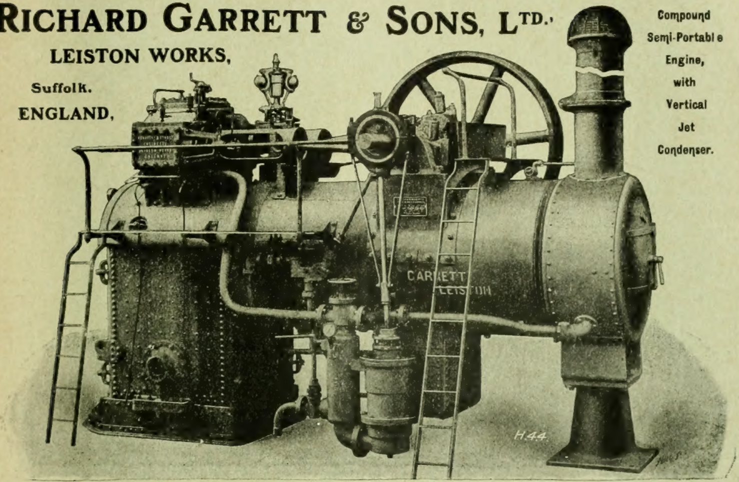

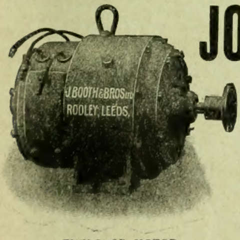

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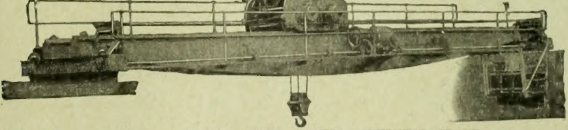

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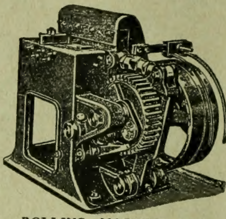

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